

AGRICULTURAL CHEMICALS



POWCO TOXAPHENE

better formulations in both emulsions and dusts

POWCO BRAND 4, 6 and 8 lb. TOXAPHENE EMULSION CONCENTRATES are stable in hard and highly alkaline water. They are designed to be effective where emulsion problems are most difficult as well as where softer water is available.

POWCO BRAND 40% TOXAPHENE DUST CONCENTRATE is dry and free-flowing—will not ball up or “bridge” in the hopper—evenly impregnated for ease of blending and maximum effectiveness of finished product.

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KILLING POWER—THAT'S THE THING!

LOOK TO POWELL...FOR CONSISTENT, TROUBLE-FREE QUALITY



OPERATION 1952

Increased productivity of agriculture is essential to a sound national economy which must be maintained in 1952.

As we begin this new year, P.C.A. renews its pledge of full cooperation to the fertilizer industry and all agencies working to achieve this production goal.

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Second of a series designed to tell the story of the pesticide industry's leading carrier and diluent.

Why is Attaclay a "natural" for formulating liquid toxicants?

... because it puts more of your carrier dollar into carrying

Viscous or "watery" poison—dust base or wettable powder—high or low concentration—rely on unfailing Attaclay to do a fine, low-cost job as carrier and diluent.

Attaclay's Documented Abilities

Great sorptive capacity to make, for example, a 40% toxaphene base that is dry, free-flowing, lump free.

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Speed-up ability to cut cycle times for impregnation and the following attrition milling or grinding steps.

Non-abrasiveness to prevent down-

time and add life to mills, blenders, screens and conveyors.

Over-all efficiency to ease processing steps and deliver powders which blenders and growers label "premium."

Doesn't it make sense to put your dollars into a carrier that shows tangible bonuses all the way from formulation to field? We invite you to discuss the matter with us.



ATTAPULGUS CLAY COMPANY

Dept. P, 210 West Washington Square, Phila. 5, Pa.

YOU'LL WANT THIS—the first booklet in a newly-inaugurated series called *Attaclay Pesticide Digest*. These bulletins will discuss various aspects of pesticide processing. A brief note will bring your copy, and future Digests as published.

AGRICULTURAL CHEMICALS



**A Monthly Magazine
For the Trade**

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THIS MONTH'S COVER:

Meet S. B. Tatem, newly-elected president of the California Fertilizer Association. Mr. Tatem is with Swift & Co. plant food division, Los Angeles. He has been a member and booster of the CFA for many years, and is well known in West Coast agricultural circles

VOL. VII

No. 1

JANUARY

1952

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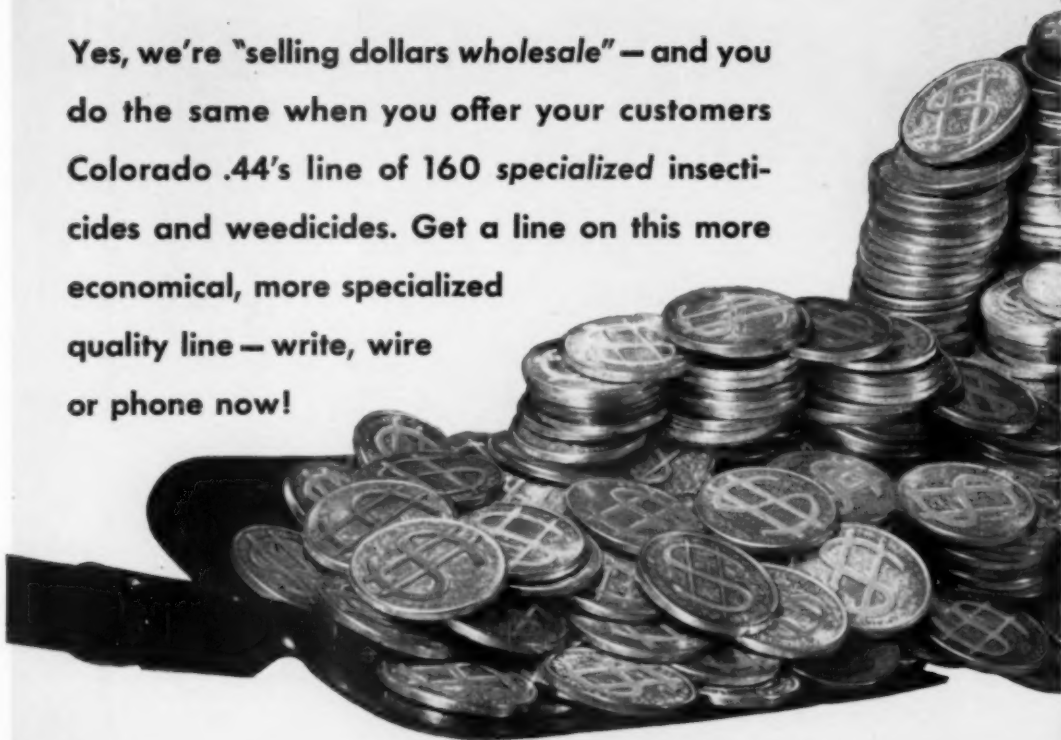
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Entered as second-class matter November 4, 1949, at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

Colorado .44

means **MORE PROFIT**
to **YOU** in '52

Yes, we're "selling dollars wholesale" — and you do the same when you offer your customers Colorado .44's line of 160 specialized insecticides and weedicides. Get a line on this more economical, more specialized quality line — write, wire or phone now!



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Box 777, Denver, Colorado — Phone AComa 5895



Here's a versatile, fast-moving item which will sell because of its effective action against boll weevils, grasshoppers, locusts and many other pests. Colorado 44 Aldrin features quick action, low dosage, ease of use, and economy.



For better, more economical control of a wider variety of agricultural pests, we suggest Colorado 44 Toxaphene. Colorado 44 Toxaphene is particularly potent when used against grasshoppers, alfalfa weevils, army worms, cutworms, lygus bugs, aphids and a variety of cotton pests.



If you're in the market for a profitable item for effective cotton and livestock control, don't overlook Colorado 44 BHC. Show the farmers how they, too, can reap greater benefit through Colorado 44 BHC.



Profit-eating livestock pests die fast when Colorado 44 Dairy Spray is used. This powerful insect killer will not harm cattle or humans if used as directed. It's a fast seller, and is fully approved by the USDA for use on dairy cattle. Non-toxic, non-injurious to livestock, poultry and warm blooded animals.



Weeds that rob crops of moisture, sunlight and vital minerals are always a problem to farmers. However, with Colorado 44 2,4-D ester and amines in many economical formulations, weed and brush control can be achieved at a minimum of cost and labor. It will be of great benefit to you, because it's of great benefit to the farmer.



Sell widely-used Colorado 44 DDT to farmers and watch your profits soar. Colorado 44 DDT is an effective control against alfalfa weevil, lygus bugs and many other destructive insect pests. It is particularly profitable in the corn belt, for Colorado 44 DDT effectively controls the major pest of the corn crop.



To stop livestock weight losses resulting from ticks, lice and flies, recommend Colorado 44 Livestock Spray to your customers. It's the best solution for adding pounds to your cattle and other livestock, because it eliminates the annoyance of weight reducing pests. Colorado 44 Livestock Spray is also highly effective as residual control in and around barns.



Recommend Colorado 44 Parathion. This versatile insect killer destroys the green bug in wheat and all small grains. Carry Colorado 44 Parathion and make your profits and the farmer's income greater. Also unusually effective against aphids, army worm and many other destructive insects.



For effective control of mites, lice, flies and fleas on livestock, recommend Colorado 44 Lindane. Customers will appreciate the outstanding results of Lindane in controlling livestock pests. Lindane is also formulated to destroy many other agricultural insect pests—including grasshoppers and ants.



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Colorado 44 Grub Dust gives almost 100% protection against cattle grubs and lice, thus reducing livestock weight losses. Can be used as a dust, spray or dip. Just add a 7 1/2 lb. pack of Colorado 44 Grub Dust to each 100 lbs. of water—it kills cattle pests fast! Profits come naturally.



Colorado 44 245-T helps farmers make a better harvest faster, easier and at less cost. This means more profit and more good will for dealers, for Colorado 44 245-T is an effective weed and brush killer. STOCK! DISPLAY! SELL! Colorado 44 245-T.

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Partial aerial view of Naugatuck Chemical test fields and lab at Bethany, Connecticut

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Here's where Naugatuck chemicals begin—where **Spergon®**, **Phygon®** and **Aramite®** first showed signs of becoming the nationally famous products they are today.

Here's where Naugatuck Chemical's seed protectants, spray fungicides and insecticides of tomorrow must meet the tests of effectiveness,

economy, plus ease and safety of use.

Yes, and here's where sales are sown! When the benefits of the Naugatuck chemicals developed here eventually reach the grower, they also reach the supplier and distributor in the form of new sales and new profits.

*U. S. Pat. No. 2,529,484

UNITED STATES RUBBER COMPANY

Naugatuck Chemical Division • Naugatuck, Connecticut



manufacturers of seed protectants—Spergon, Spergon-DDT, Spergon-SL, Spergon-DDT-SL, Phygon Seed Protectant, Phygon Naugets, Phygon-XL-DDT, Thiram Naugets—fungicides—Spergon Wettable, Phygon-XL—insecticides—Synklor-48-E, Synklor-50-W—fungicide-insecticides—Spergon Gladiolus Dust, Phygon Rose Dust—miticides—Aramite.

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in your high-analysis mixes

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DISPERSION**

use
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a balanced anionic emulsifier for agricultural insecticides

TOXIMUL is the family name of Ninol Laboratories' new series of Emulsifiers, designed to improve performance and reduce costs of biocidal spray concentrates. Various members of the series have been developed for use with different types of insecticides such as Toxaphene, Chlordane, DDT, etc.

TOXIMUL 100, for example, features *spontaneous dispersion* when used in Toxaphene emulsion concentrates. When added to water of any hardness, concentrates containing TOXIMUL 100 form stable emulsions with a minimum of agitation. Such concentrates are therefore ideal for general agricultural use, and particularly where agitation conditions are poor . . . as in aeroplane sprayers, knapsack tanks and cattle dips.

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Keep up with agricultural chemical progress in 1952!

The Agricultural Chemical industry has been termed one of the fastest-developing enterprises in existence today. Keeping pace with these developments is a MUST for every one connected with the production, sale and use of these materials.

Don't let your subscription to AGRICULTURAL CHEMICALS expire. Read the magazine upon which the entire trade depends for up-to-the-minute information. Make use of the coupon below and be sure that you won't miss a single copy of the magazine!

Samples of Articles Scheduled for 1952:

- "Research and Educational Activities of the Plant Food Industry"
- "Seed Treatment for Control of Wireworm"
- "How Agricultural Chemical Dealers Advertise"
- "Soil Use of New Insecticides"
- "Factors Influencing Efficiency of Fertilizer Conditioners"
- "Sampling and Analysis of Soil Containing Certain Insecticide Residues"
- "Trace Elements in Fertilizers"
- "Evaluating Agricultural Emulsions"
- "U.S.D.A.'s Annual Fertilizer Consumption Report"
- "Status of Herbicide Poisoning"
- "CMU Weed Killer"

In addition, accurate, prompt reports on important meetings of trade associations, scientific groups on national, state and regional levels, and industry news.

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THIS compact unit makes an economical installation for insecticide plants. It provides a clean, dustless system for automatically handling the material from feeder to finished product bin.

The Imp Mill is especially adapted for grinding and blending operations in producing field strength insecticides. A wide range of fineness is easily obtainable to 95% or better passing 325 mesh by one simple adjustment.

Whatever your dust formulating problem may be, Raymond equipment offers you an economy-proved method of production.

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Raymond
PULVERIZER DIVISION

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JANUARY, 1952

13



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Growing constantly in popularity with industry's largest users of paper bags—**Fulton's** famous Multiwalls. All types—pasted or sewn bottom, open mouth or valve. **Fulton** makes the Multi-wall to fit your product!

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Wettable Powders
Dust Concentrates
Emulsifiable Solutions

BHC

Technical grade (36% gamma)
12% gamma Concentrates

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Acid
Sodium Salt
Butyl Ester
Isopropyl Ester
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2,4,5-T

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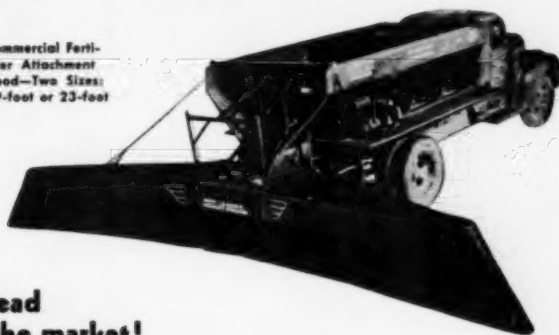
Manufacturers of Agricultural Chemicals

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AGAIN!
"The NEW LEADER"
leads the field

with its new
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offering greater accuracy of spread
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Commercial Fertilizer Attachment
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SPECIAL ADVANTAGES—Uniformity of spread is not dependent on truck speed. Motor is mounted on catwalk and drives only the twin distributor discs at a constant speed, assuring full width of spread at all times together with uniform distribution.

Conveyor is separately driven from truck drive shaft by a series of V-belts to deliver the correct amount per acre—regardless of truck speed or regardless of whether the truck is driven in low, super-low or any other gear.

Conveyor speed is, therefore, positively syn-

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Note: When Spreading Attachment is folded up for road-traveling position, width is approximately 7'-5".



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The 20-ton capacity transport above is shown with elevator in place and ready to load a NEW LEADER Spreader truck. These units are proving very profitable; in bad weather they eliminate demurrage on railroad cars; fertilizer gets to the job quickly and spreader trucks can be kept working in the field. The transport, being a self-unloading unit, leaves the tractor truck free to return to pick up another transport load. These

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FREE! Write for "The Story of a Custom Fertilizer Spreading Service"

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MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF SPREADERS



Pittsburgh

Brush Killers have **SELF CONTROL**, too!

You can count on PITTSBURGH Brush Killers to concentrate and confine their killing action to the sprayed areas only. This "self control" is the result of the low volatile Tetrahydrofurfuryl Esters (THFE)[†] which all PITTSBURGH Brush Killers now contain.

For ease and economy of use, plus this NEW safety
U. S. Patents Pending

to nearby valuable crops, use PITTSBURGH Brush Killers.

10-20 BRUSH KILLER: General farmland clearance.

BRUSH KILLER 22: Rangeland clearance, rights-of-way.

10-VOL 4: Mesquite, briars, hard-to-kill woody growth.

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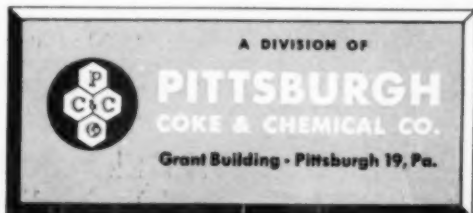
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AND 1985



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Now there was a recommendation!



Marco Polo advised the camel drivers...

... to use crude mineral oil on their camels for the mange. It seems that back around the year 1290 the faithful "ship of the desert", always a mangy animal at best, was having a little more trouble than usual. That humped-back supply line so vital to Arabia was beginning to bog down.

Marco Polo gathered the grizzled drivers about him and extolled the wonders of crude mineral oil—a primitive recommendation but those were primitive times.

Today's agricultural authorities have a wide choice of compositions at their command whether the infestation concerns livestock or crops. Such organizations as Geigy Company, Inc. are mobilized to formulate products which will meet the most exacting requirements and conditions.

Therefore, whatever *your* requirements remember that Geigy Company, Inc. represents the highest standards of quality, dependability and service.

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BHC
Carbamates

Chlordane
Copper
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Dieldrin

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To pack the most liquid
in a dry dust . . .

... use **CELITE**

By USING Celite powder to absorb liquid poison, you can obtain the most highly concentrated dust and at the same time cut packaging and shipping costs!

That's because Celite is a diatomite powder with an unusually high liquid absorption capacity. It can absorb its own weight in liquid poison and still remain "dry."

In addition, the presence of Celite in the final dust will help neutralize the effect of heavy extenders . . . thereby insuring better dispersion of the poison. Celite can do this because of its great bulk per unit of weight and the irregular shape of its particles.

Celite can be used with equally effective results in your primary grinds. It aids in the grinding of both solid and semi-solid low melting point poisons, and helps make a much more potent dry dust concentrate.

It will certainly pay you to look into the use of Celite as an inexpensive means of improving your product and increasing your profits. For further information, write to Johns-Manville, Box 290, New York 16, New York.

Properties of CELITE

FINENESS: Approximately 100% through 325 mesh

DENSITY (Vibrated): 11 pounds per cubic foot

BULK: Celite bulks much higher than most diluents

ABSORPTION: 200% of its weight of water
300% of its weight of kerosene

pH VALUE: Below 7.0

INERTNESS: Compatible with insecticide and fungicide poisons

SUSPENSION: Excellent in both air and water

COMPOSITION: Celite is amorphous diatomaceous silica (SiO_2)

Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.



Johns-Manville **CELITE**



DILUENTS AND GRINDING AIDS

AGRICULTURAL CHEMICALS



aldrin • dieldrin

Wipe out Boll Weevil...

Weevils and other cotton pests may not be as easy to destroy in the field as they are to erase from a blackboard, but Aldrin and Dieldrin have made the job a lot more dependable and economical than it has ever been before.

Aldrin and/or Dieldrin are now recommended by the cotton-growing states of the South for boll weevil control as well as for control of many other cotton pests. Because Dieldrin is especially effective against the following marauders in addition to weevil, it is ideally suited to early season cotton insect control: armyworms, cutworms, darkling beetles, fleahoppers, grasshoppers and thrips. Neither Aldrin nor Dieldrin is effective against bollworm, and when this pest is to be controlled, Aldrin and Dieldrin formulations should contain DDT.

With cotton selling around 40¢ per pound, formulators will be well advised to have Aldrin and Dieldrin spray and dust concentrates available to supply their dealers' demands for these proven insecticides.

In view of the wide variety of insects and conditions prevailing in the cotton growing areas, federal, state and local recommendations should be followed explicitly, and proper application of insecticides be emphasized.

Write for complete information about Aldrin and Dieldrin.

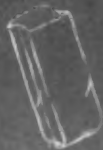


Julius HYMAN & Company

DENVER, COLORADO

SHELL CHEMICAL CORPORATION, New York City, are exclusive distributors of unformulated Aldrin and Dieldrin in the United States.

*The least expensive
and most satisfactory
package for many
chemical products is
a paper bag*



If you manufacture dry chemicals sold in units up to 25 lbs., you probably can package effectively in paper bags—at substantial savings.

Union's versatile CHEM-PAK bags can provide the kinds of protection your products need. They are sift-proof. They are being made to lock out moisture, odor, grease, vapor, corrosion. They resist rough handling. They also can retard

flavor loss and product deterioration.

You pay less for CHEM-PAK than for other comparable packages. You save on filling, sealing and handling costs. You reduce freight charges. You cut losses from package damage or breakage.

Measure your present container against CHEM-PAK. Send for new *Package Evaluator* or ask to see a Union representative.

Union's modernized plant at Hudson Falls, N. Y. Billion-bag specialty packaging headquarters.



CHEM-PAK BAGS FOR FERTILIZERS—INSECTICIDES, FUNGICIDES, BUSTING POWDERS—PLANT FOODS—WALL SIZE—PASTE FLOUR—PATCHING PLASTER—PREPARED CEMENT—PLASTER OF PARIS—PHARMACEUTICAL CHEMICALS—DYES AND PIGMENTS—SANITARY CHEMICALS—POWDER SHAMPOOS—CHLORINE COMPOUNDS AND ALKALIDES—CAULKING, SEALING, WHITING AND FILLING COMPOUNDS—AND OTHER DRY CHEMICALS WITH COMPARABLE PACKAGING REQUIREMENTS

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Please send me the new Chemical Package Evaluator.

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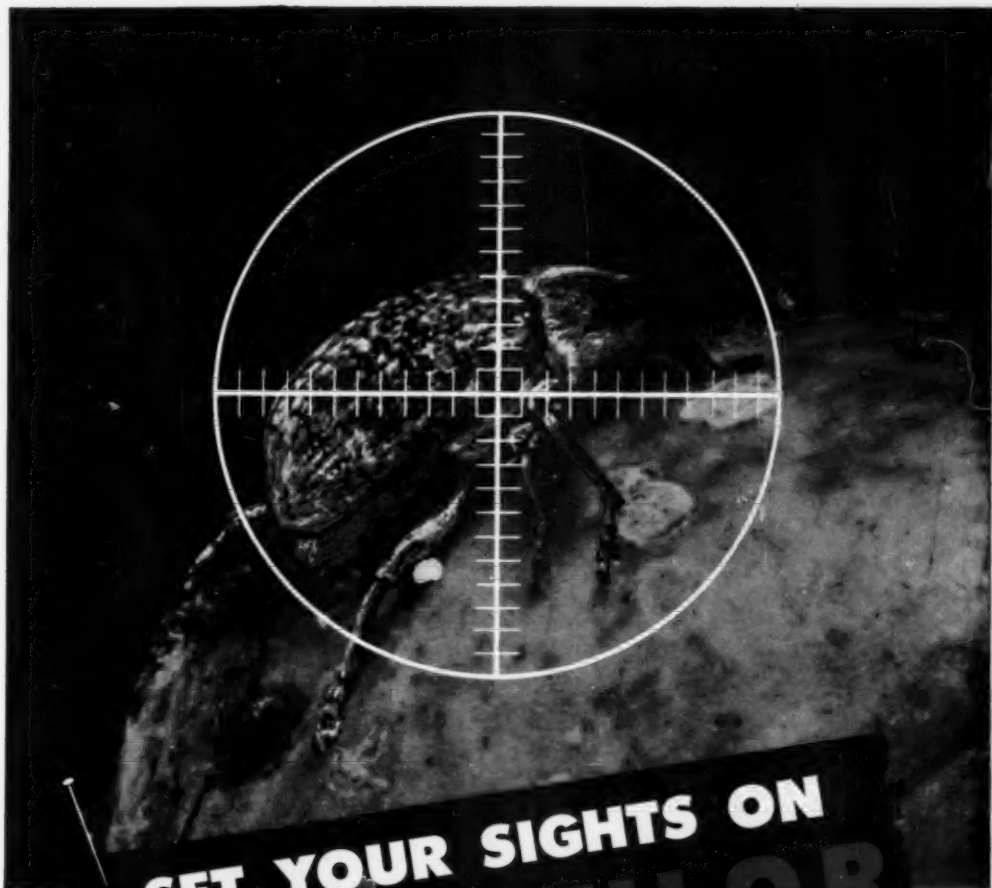
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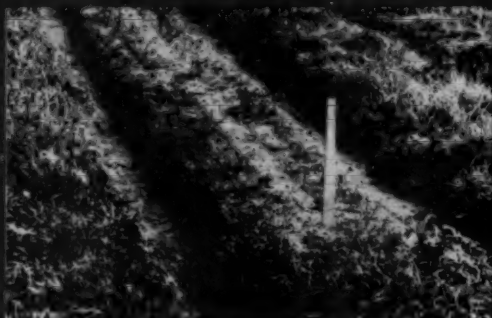
AGRICULTURAL CHEMICALS

This Year's Study of Columbia-Southern Chloro-IPC Reveals

PROMISING NEW HERBICIDE



Pre-emergent treatment of cotton with Chloro-IPC. Note control of grass in 7-inch bands on each side of row.
Photo courtesy of Edisto Experiment Station, Blackville, S. C.



Post-emergent treatment of onions. Chloro-IPC was hand sprayed when onions were 1/2 inch to 1 inch high.
Photo courtesy of Jack Wilson Chemical Company, Stockton, Calif.

Columbia-Southern, which has taken the lead in the development of Chloro-IPC, placed this herbicide before important agricultural research groups for testing. The results from many experiments made by these groups have shown Chloro-IPC to have outstanding promise.

Information collected to date indicates that Chloro-IPC may be used to control certain annual grass and broad-leaved weeds in the production of cotton and onions.

Columbia-Southern Chloro-IPC selectively retards cell division in the primary structures of germinating seeds and very young seedlings. All available evidence indicates that Chloro-IPC is not translocated in plants.

For these reasons Chloro-IPC should be present in the soil at germination or in the very early seedling stage of the weeds to be controlled! If application is made to the aerial parts of plants, even the susceptible varieties, little or no herbicidal effect will be noticed. Since adequate soil moisture promotes rapid germination of weed seeds, Chloro-IPC manifests its optimum effects under such conditions.

Field tests have shown that in most cases the effective dose of Chloro-IPC is about six pounds per acre, although in the case of crops which are easily in-

jured, lower dosages—for example two to four pounds per acre—have been used with some success. The soil type also appears to regulate the effective dose. Heavy soils and muck require higher doses than light sandy soil.

The herbicidal effects of Chloro-IPC last about four to six weeks in the soil although both longer and shorter periods have been reported. Soil temperature seems to be the most important factor and rainfall secondary. In general, the higher the temperature, the shorter the effective period.

One-half gallon of emulsifiable Chloro-IPC (containing four pounds of active ingredient per gallon) in about ten gallons of water is sufficient to spray one acre of cotton. Of course the spray is adjusted to treat only the 14-inch bands directly over the row; the untreated 26 inches in the middle is weeded by cultivation. The application is preferably made at the time of planting but post-emergent applications may be made if necessary, using sprays to direct the herbicide onto the ground beneath the plant. Reasonable care should be exercised to prevent the spray from contacting the cotton plant even though it is known that Chloro-IPC has only a very slight effect on the leaves of the cotton plant.

Also promising is the use of Chloro-IPC in onions. In this case again about six pounds of Chloro-IPC per acre is the optimum dosage. If only bands over the rows are treated such as in the example of cotton, then reduced dosages may be used; calculated from the ratio of the treated area to the total area. Both pre-emergent and post-emergent applications have been successful. The important thing to remember is that Chloro-IPC should be present in the soil at germination or in the very early seedling stage of the weeds to be controlled!

Results of field testing with several other crops will be reported in the following issue.

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THE EDITOR COMMENTS

THE continuing need for control of insects affecting cotton was quite evident from statistics brought to light at the recent Memphis conference. At this session, it was noted that damage to cotton by insects in 1951 was extensive, although lower than losses in the two years previous. The amount of loss wasn't quite as significant, however, as the fact that boll worm, pink boll worm, aphids, thrips, cutworms and mites are becoming more serious while the boll weevil is being controlled. Thus it is easy to see why the conference emphasized the fact that the problem of insect control can be solved only by eternal vigilance. Swift and effective action on the part of farmers will have to be the rule if better control of all these pests is to be realized.

It follows, of course, that proper materials must be on hand at the time and place of infestation. Adequate preparations must be made for the availability of insecticides for the coming season, particularly in view of an impending shortage of cotton and the need for another enormous crop. The U. S. D. A. and State agencies have already started on the all-out production effort, and plans are under way for planting 26 million acres of cotton!

Even though the agricultural chemical industry produced more than a billion pounds of pesticides in 1951, it is of most importance that farmers, dealers, distributors and manufacturers get their production and buying plans under way early for the materials needed for next year's crop. Production of organic insecticides is a complex process, easily upset by bottlenecks in distribution to the field. With storage space limited at the plants and distribution points, it is necessary for farmers to take in at least part of next season's requirements in advance of actual needs, so that the normal flow of materials may be continued.

Yes, we know that inventories of cotton insecticides are generally higher than those of 1950, but it should be remembered that the infestation during 1951 was light. Assuming that

the insects come back in their normal cycle, this year can see a great increase in consumption of pesticides. And in that case, the cotton belt will need all the materials it can get.

ADDDED to the rather considerable amount of evidence refuting claims that the use of pesticide chemicals on growing food is harmful to human health, the National Research Council recently made its voice heard above the din and confusion surrounding the issue. It noted that these chemicals are essential in the production and processing of many crops and that after a year's study of data, there is no evidence that consumption of foods resulting from the use of new chemicals in crop production or in the processing of foods has created mysterious diseases and epidemics or endangered the health of the people.

The Council spoke plainly and forcefully in giving agricultural chemicals a clean bill of health. "Contrary to some ideas that have been circulated," it said, "reliable food processors have not reduced the nutritional quality of our foods or created inferior products through the use of chemical additives. Actually, the quality and sanitary characteristics of our foods have been improved."

It then gave a pat on the back to both the industry and state officials in cooperating to protect public health. Said the statement, "It is to the credit of industrial concerns and law-enforcing agencies that they have been able to make so much progress without jeopardizing the health of the public."

To lend credence to the above, it should be remembered that these statements are the responsible utterances of outstanding scientists, nutritionists, government specialists and industrial research directors working together on a food protection committee. It seems a shame that their findings can't receive the same attention from the press that a number of recent less responsible declarations have enjoyed.

Here is the story of a relatively new insecticide for which many uses have been found. It is the essentially pure gamma isomer of benzene hexachloride, now called

Lindane

OFTEN called the most versatile of insecticides now in use, lindane is a fascinating product of modern chemical technique and achievement. It originated during World War II, when industry and agriculture were hard pressed to find organic and chemical substitutes for such insecticides as lead arsenate. At the time the United States was investigating and putting DDT into military, and later into agricultural use, England was developing benzene hexachloride, the parent compound of lindane.

The material developed and used in England was a commercial

grade of benzene hexachloride containing not over 13% of the gamma isomer and approximately 87% of the four isomers in mixed proportions plus a small amount of other related impurities. The gamma isomer, it developed, was the only part of the mixture having any value for insecticidal action while the other isomers imparted only odor, or other undesirable qualities to the compound which often resulted in taste or odor residues on treated crops.

Toward the end of World War II, BHC was brought to the United States and tested. One of the first companies to work with it

was the California Spray-Chemical Corporation. Realizing that a pure gamma isomer or a gamma isomer compound without the presence of the other undesirable isomers would be an excellent insecticidal material, Calspray interested the Hooker Electrochemical Company at Niagara Falls, New York, in producing this chemical for them. In 1945, the Hooker Company started development work on lindane, with the first experimental lots of the material being developed in 1946 and 1947. At this time, the material was 95% gamma with a small percentage of the other isomers still remaining. By



by
G. S. Hensill

Assistant Manager, Research and
Development,
California Spray-Chemical Corp.,
Richmond, California



1948, however, Hooker was producing a 99% gamma and later, they obtained up to 100% gamma material. The development of excellent production methods has resulted in material at present averaging 99.5% gamma and much of it 100% pure gamma isomer of BHC.

Chemical Characteristics

THE name lindane was approved for the pure gamma isomer of BHC in 1949 by the United States Department of Agriculture. It honors the Dutch chemist, Vander Linden, who originally isolated and described the gamma isomer. Chemically, it is designated as the gamma isomer of 1, 2, 3, 4, 5, 6 hexachloro cyclohexene, a chlorine saturated benzene ring compound. It is a white crystalline substance similar in appearance to granulated sugar, the granules being somewhat coarser. The material has a melting point of 112° C., a vapor pressure of one-hundred thousandths mm. at ordinary temperatures, 2mm. at the temperature of boiling water. The chemical breaks down in the presence of strong al-

kalis or strongly alkaline solutions.

In general characteristics, lindane as it was produced in initial quantities was found to be satisfactory to the entomologists as an insecticide. The pure gamma isomer retained all of the excellent killing power of the original parent compound. It retained residual action quality similar to that of BHC, DDT and other organic chlorine insecticides. Although lindane as such does not have as long a residual insecticidal life as some of the other chemicals, it appears to make up in effectiveness what it lacks in residual action. The chemical is more efficiently toxic to insects than commercial benzene hexachloride, its parent compound, and is approximately 5-10 times more toxic to insects than DDT. Thus, much smaller amounts of it are required to control various insects than in the use of other organic chlorine insecticides.

Versatility: Obvious from the first was its versatility as an insecticide. Even now new uses are being discovered. During the past 5 years of experimental work with it, lindane has been found to control more species and types of animal and plant insect pests than any other insecticide now or previously in use. This is due largely to its faculty of having a three-way insecticidal action of stomach poison, contact poison and vapor action poison. This action, unusual in insecticides, is not displayed to such an extent in any

of the related organic insecticide compounds.

Low Toxicity

THE low toxicity of lindane to warm-blooded animals is of course very favorable to its use. In chronic toxicity, it is about $\frac{1}{4}$ as toxic as DDT and shows practically no dermal toxicity. The oral toxicity is likewise of a low nature. Nor does lindane build up in body tissues as does DDT, but is eliminated at approximately the rate of intake and is therefore not a dangerous material to be taken into an animal's body through use or other method. It has a such a high safety factor in reference to toxicity that it has been approved by the U.S.D.A. for spraying dairy barns and dairy cattle, the latter for such difficult-to-control parasitic infestations as mange and scab. It is also possible to use it to some extent on certain crops well up to harvest time because residues disappear fairly quickly. On many plants, minimum residues are found remaining. For instance, it can be applied to alfalfa and foliage crops as late as two weeks before harvest and foliage cut and fed to dairy animals.

Not Toxic to Man

TO date, within the scope of research information, there has been no undesirable residual deposit recovered from treated fruits or vegetables where proper formula-

IN THE PHOTOS

Page 30: Lindane being used in outside area on beef cattle. It can also be used in and around dairy barns and on dairy cattle.

Right: Calf care is regarded as important, particularly in protecting animals from screw worm attack. Here lindane is being applied to small calf as an early protection. Only a small amount of the compound is necessary on new-born animals.

tions and amounts of lindane have been used and applied with proper timing. Likewise, there is no known record of poisoning to man or animals from applying the insecticide to food or eating food treated with the insecticide.

Easy to Formulate

IN addition to being versatile in action and use, lindane is also easy to formulate in wettable powders and in emulsive and liquid insecticides. It can be formulated into wettable powder concentrations of almost any desired strength; it can be formulated into dusts of from 1 to 2% or as desired; it can be formulated into excellent emulsive or liquid concentrate formulations at the approximate range of 1-3/4 pounds per gallon of solvent carrier. Lindane likewise has good solubility in quite an effective range of solvents.

Compatibility With Other Insecticides: In general, lindane is compatible in all formulations with various other insecticidal materials used at present including DDT as well as fungicides such as coppers, the carbamates and sulfur. As a result, many excellent formulations containing lindane and fungicides in combination with other insecticides are being produced for agricultural work both in the plant and animal use fields.

Uses: The uses of lindane are widespread and of varying possibilities. In agriculture in general, lindane has three major uses—on crops, on animals and as a soil insecticide. In the garden, the chief use for lindane is to control insects on plants and in the soil.

Use on Crops: Various formulations such as wettable powder, dusts and emulsive liquid sprays are used on agricultural crops ranging from forage, vegetable and fruit crops through field crops, etc. to control over 200 insect pests. These insects include aphids, alfalfa weevil, army worms, various caterpillars, plant bugs, Diabrotica beetles, earwigs, grasshoppers, wireworms and other soil insects. As is the case with other insecticides, applications to crops have to be made with certain spe-

cific conditions and timed according to development of the crop.

Use on Animals: Lindane can be used generally on animals. High dosages are not required. Some cautions are required and especially its use on very young animals should be careful and according to label or manufacturer's recommendations. Federal agencies and experiment stations throughout the country have obtained outstanding results in control of various animal insect pests with this insecticide.

The Federal approval of its use for dairy barn spray to control flies aided very materially in protecting dairy cattle as well as other cattle and milk and food products from fly nuisance and contamination. Lindane controls all varieties of flies such as house flies, horn flies and stable flies. In addition, lindane is excellent for controlling mange on cattle and other animals and for controlling both the Sarcoptic and Psoroptic manges. It is the only modern insecticide for which such a claim can be made. Its results have been almost phenomenal and the control of the infestation in animals decimated by the attack of mange has been striking in many cases. On animals, lindane will also control lice, fleas, ticks, sheep ticks, mosquitoes, and other animal-infesting insects.

A Superior Screw Worm Control: One extraordinary type of insect control developed from using Lindane is combination with DDT as a liquid screw-worm remedy in a special type solvent. Applied to wounds or screw-worm infested wounds, it prevents infestation or if maggots are in wounds forces them out, killing the maggots and preventing re-infestation for several days while promoting rapid and clean healing.

Use as a Soil Insecticide: Soil

insects controlled by lindane include wireworms, various maggots such as corn seed maggot, onion maggot, white grubs, sod web worms and other insects inhabiting soil areas. For controlling wire worms, it can be applied most effectively by adding a few ounces to each 100 lbs. of seed prior to planting time. It can also effectively control wireworm and other soil pests in the form of wettable powder, dust or liquid formula. Its persistence in soil varies with amounts applied. On potato land, annual rotation is required if treatments up to 1/2 lb. lindane per acre are used. Ordinarily, 1/4 pound of actual lindane per acre is sufficient for effective wireworm control. Smaller amounts such as used in seed treatment are for the protection of newly established crops and last sufficiently long for plantings to become established without damage.

In addition to the many uses outlined above, lindane in various formulations controls termites, powder post beetles, crab lice, human lice and various stored food or granary pests. These comprise more or less special types of control and to some extent require special formulation.

Household insects comprise another wide use for lindane. It can be applied for household pest control by various vaporizing or atomizing equipment as well as in dust and conventional spray form. Recently a vaporizing method was developed to control insects. The technical lindane (basic chemical) is heated to 110° C. in a vaporizing apparatus which liberates about 1 gram of lindane per each 15,000 cubic feet of air per day. This vaporizing method is effective for control of flies, mosquitoes and various other insects. Lindane is also adaptable for use in aerosol bombs.★★

Low toxicity to man, ease of formulation, effectiveness in controlling important agricultural insect pests combine to make lindane an unusually versatile insecticide

Cincinnati scene of big joint meeting between

ENTOMOLOGISTS and PHYTOPATHOLOGISTS

MORE than a thousand persons attended the joint meeting of the American Phytopathological Society and the American Association of Economic Entomologists at the Netherland Plaza Hotel, Cincinnati, during the week of December 10-13.

Both groups emphasized studies on toxicology, pointing out that further legislation is unnecessary to regulate the manufacture and sale of agricultural chemicals and that the public health hazard has been largely exaggerated in recent press releases. Several joint symposia were held with both entomologists and plant pathologists participating in the discussions, and a total of nearly 300 papers were presented at the day-and-night sessions of the two groups. Near-record attendance was on hand, with the entomologists having some 650 registered and the phytopaths more than

500. (A number of persons registered at both meetings, making it difficult to state accurately the total attendance.)

Phytopath Meeting

THOMAS T. McClure, Michigan State College, was leader of a section on fruit fungicides on Monday. During this session, Alvin J. Braun, Geneva, N. Y., discussed the control of Black Rot and Downy Mildew of grapes with concentrate sprays,

dry dusts and wet dusts. He said that data from nine separate tests indicate that disease control with concentrate sprays (25 gallons per acre) is comparable to that obtained by an equal number of regular spray applications of 100 gallons per acre. Dry and wet dust applications were equally effective in tests where disease development in the check plots was moderate.

"Organic versus Inorganic Fungicides for control of the Brown Rot Fungus on Peaches" was the title of a paper presented at this session by H. H. Foster, South Carolina Agricultural Experiment Station. He said of ten spray treatments in randomized single tree plots, only three appeared to be sufficiently effective for practical control of brown rot. These were wettable sulfur (6 lbs. per 100 gal.), "Orthocide 408" and manganese ethylene bis dithiocarbamate. He added that peaches

In the Photos:

Below: Outgoing presidents present good wishes to their successors. In the left-hand picture, Dr. E. F. Knipling, (left) newly-elected A.A.E.E. head, receives congratulations of Dr. Roy E. Campbell, retiring president.

In the right-hand photo, Dr. George L. McNew, (left) APS president for 1952, receives gavel from Dr. James G. Horsfall, outgoing phytopath head.





Photos This Page

Top row, L to R: Dr. L. B. Norton, Cornell University; Dr. C. J. Krister, E. I. duPont de Nemours & Co., Wilmington, Del.; J. A. Evans, Washington, D. C.; and W. C. Keenan, duPont.

Second Row: Dr. C. H. Curran, American Museum of Natural History, New York; Ed. M. Searles, U. of Wisconsin, Madison; Fred M. Snyder, Army Chemical Center, Maryland; and David Lynch, Prentiss Drug & Chemical Co., New York. Avery S. Hoyt, chief, Bureau of Entomology and Plant Quarantine, U.S.D.A., Washington, D. C.; M. R. Clark, representing the Director of Agricultural Research for Defense; and Dr. S. B. Fracker, Assistant Departmental and International Relationships of the ARA, U. S. Dept. of Agriculture.

Gilbert J. Haussler, and David Hall, both of the B.E.P.Q., U. S. Department of Agriculture, Washington, D. C.; and Lloyd E. Adams, State College, Pennsylvania.

Third Row: E. P. Reagan; Kenneth Messenger, W. L. Popham and Kelvin Dorward, all of the Bureau of Entomology and Plant Quarantine, U. S. Dept. of Agriculture, Dr. J. A. Cox, Penn State College; Dr. Harry J. Walker, Pennsylvania Salt Mfg. Co., Whittemarsh Laboratories, Philadelphia; and Dr. E. F. Taschenberry, New York State Agricultural Experiment Station, Geneva, N. Y.

Fourth Row: C. P. Clausen, ex-president of A.A.E.E., U. of California, Riverside; Roger C. Smith, Manhattan, Kansas, president, North Central Branch, A.A.E.E.; Roy E. Campbell, retiring president of A.A.E.E. and W. P. Hayes, University of Illinois, past president of the Entomological Society of America. Lloyd W. Ford, Imperial Valley Insecticide Service Co., Imperial, Calif. and Ed. Littooy, vice-president, Colloidal Products Corp., San Francisco.

Fifth row: Richard P. Porter, Ethyl Corp., New York; Alfred J. Kolka, Ethyl Corp., Detroit, Mich.; Dr. Charles L. Smith, Ethyl Corp., New York; Dr. Bruce D. Gleissner, Jr., American Cyanamid Co., New York; and Calvin Wolf, Ethyl Corp., Detroit. Dr. Donald Starr, S. B. Fenick & Co., New York; J. R. Bussart, Veliscol Corp., Chicago; W. C. Edgar, NPA, Washington, D. C.; and E. L. Thomas, Swift & Co., Chicago.

Sixth row: H. B. Petty, Illinois Natural History Survey, Urbana; Paul A. Dahm, Kansas State College, Manhattan and Lester Ingie, Univ. of Illinois, Urbana. Dr. Robert Roth, Commercial Solvents Corp., New York; and Morton Leonard, Julius Hyman & Co., Denver, Colo.

Seventh Row: Dr. L. M. Peairs, Morgantown, W. Va., editor, "Journal of Economic Entomology" and Herbert F. School, Public Health Service, Atlanta, Ga. C. M. Beckman, Ga. Agricultural Experiment Station, Experiment, Ga.; R. N. Holmaster, Norfolk, Va.; B. C. Dickinson, U. S. Industrial Chemicals Div., Baltimore; and Dr. C. C. Alexander, Geigy Co., Inc., Bayonne, N. J.

Eighth Row: (first photo, front row) W. J. Virginia, California Packers; T. A. Brindley, U.S.D.A.; Phil Wallace, Monsanto Chemical Co., St. Louis, Mo.; and B. J. Konkright, Salinas, Calif. (back

sprayed with the "Orthocide" preparation "usually had a better color than those sprayed with wettable sulfur."

Wm. J. Young and E. S. Beneke, Michigan State College, were co-authors of a paper entitled "Treatments to Prevent Fruit Storage Rot." They stated that raspberries, strawberries, and cherries were treated with dips and volatile gas, to control storage rot. The sodium salt of dehydroacetic acid in 0.5% solution, and actidione at 2 ppm were used in dipping. Fruits were also exposed to "Sound Delivery" gas, a proprietary product. Results showed the Na material to be "excellent" in controlling common storage molds, *Rhizopus*, *Botrytis* and *Alternaria* and in preserving the appearance of fruit. Actidione was of no value in controlling mold or preserving appearance. The gas provided only fair mold control and caused bleeding of cherries and raspberries, they reported.

H. F. Winter, Ohio Agri. Expr. Station, Wooster, discussed raspberry anthracnose control as affected by fungicides, timing of sprays and methods of application. Reporting on tests made during the past year the paper reported results (given as average number of lesions per cane) were as follows: ferbam, 1.6; manganese ethylene bis dithiocarbamate, 2.9; "Orthocide 406," 2.1; "Crag 341," 11.5; ferbam plus "Phygon," 2.5. Control, delayed dormant only, 25; no delayed dormant or in foliage

row) J. H. Lilly, Iowa State College, Ames; D. L. Suggett, Soilserv, Inc., Salinas, Calif.; N. Piesbergen, Monsanto Chemical Co.; Ed. Littooy; J. M. Magner, Monsanto Chemical Co., St. Louis; and Lloyd W. Ford.

E. H. Zinn, Hercules Powder Co., Wilmington, Del.; C. A. Lewis, University of Kentucky; Joseph W. Dolsen, Advertising Manager, Hercules Powder Co.; W. A. Price, Head, Departments of Entomology and Botany, University of Kentucky.

Bottom row: W. Mercer Rowe, Ashcraft-Wilkinson Co., Atlanta Ga.; D. G. Denning, Veliscol Corp., Walnut Creek, Calif., and Frank U. Rapp, Hercules Powder Co., Wilmington. E. F. Knipling, Assistant Chief, Bureau of Entomology and Plant Quarantine, U.S.D.A., Washington, D. C., newly-elected president of the A.A.E.E.; R. C. Bushland, U.S.D.A., Kerrville, Texas; and Henry F. Pierce, Hercules Powder Co.

sprays, 78. In the timing experiment the following results were obtained (lesions per cane): delayed dormant only (L.L.S. 8 gal.), 25; delayed dormant plus prebloom (ferbam 2 lb.), 8; delayed dormant plus prebloom and postbloom (ferbam 2 lb.), 1.6; prebloom and postbloom (ferbam 2 lb.) with no delayed dormant spray, 13.

In a second experiment all of the above named fungicides were applied as 5% concentrations with an orchard concentrate sprayer at 1/5 normal gallonage. The results obtained were in all respects comparable to those obtained with dilute sprays. No discernible injury resulted from any of the sprays.

Chemotherapy Session

FUNGICIDES and Chemotherapy were discussed in a Tuesday morning session under the chairmanship of Saul Rich, Connecticut Agricultural Experiment Station. Andrew Thanos, Michigan State College, presented a paper, "Effect of Cycloheximide (Actidione) and Some Environmental Factors on the Germination of Spores of *Monilinia fructicola* and *Botrytis cinerea*". He reported on tests at temperatures ranging from 22° to 30° C, stating that actidione was most effective in inhibiting germination at 26°. At this temperature, inhibition of germination was first noted at 2.5 ppm and gradually increased until at 10 ppm no germination occurred even after 72 hr. The optimum pH at this temperature was 4.0. An experiment was also prepared to determine what effect actidione might have, when in contact with the spores of *M. fructicola* in the dry state, over a period of time from 1 to 12 months. In the dry state actidione was not significantly different from the above tests. *Botrytis cinerea* was erratic in its response to actidione. At 10 ppm it was inhibited significantly as compared to the control, while at 25 ppm a stimulation of germination was noted which decreased rapidly at higher concentrations until no germination occurred at 50 ppm. These results were obtained at 22° C. at pH 6.80.

"Comparison of Cycloheximide

Photos This Page

Top row (L to R): Dr. S. E. A. McCallan, Boyce Thompson Institute, secretary of the ASP; Dr. Curtis May, U.S.D.A., Beltsville, Md., former APS secretary; and Edgar G. Rex, New Jersey State Dept. of Agriculture, Trenton. R. B. Davidson, Alabama Polytechnical Institute; E. B. Hayden, University of Minnesota; and Frank L. Howard, Rhode Island Agricultural Experiment Station.

Second Row: Richard F. Porter, Ethyl Corp., New York, and Dr. Paul R. Miller, U.S.D.A., Beltsville, Md. Dr. J. L. Peterson, Stauffer Chemical Corp., New York; E. B. Lambert, Federal Civil Defense, U.S.D.A., Washington, D. C.; R. O. Bolger, U. of Minnesota; and Harold L. Porter, Ohio State Dept. of Agriculture, Columbus.

Third row: Unidentified conventioners chats with Drs. James G. Horsfall, Connecticut Agricultural Experiment Station, New Haven, retiring APS president and S. E. A. McCallan; Dr. H. C. Young, Ohio Agricultural Experiment Station, Wooster; Harry L. Keil, Rohm & Haas Co., Philadelphia; and Dr. J. D. Wilson, Ohio State Agricultural Experiment Station, Wooster.

Fourth Row: Dr. C. M. Tucker, University of Missouri, Columbia, former APS president and Curtis May, former APS secretary. Rosendo Postigo, Univ. of Minnesota. St. Paul; R. S. Mullin; H. W. Bockstahler, Michigan State College, E. Lansing; Dr. Helen Hart, U. of Minnesota, retiring editor, "Phytopathology."

Fifth row: Drs. G. A. Johnson and Kenneth Nolan, both of American Cyanamid Co. laboratories, Stamford, Conn.; D. J. Higgins, Ohio State University, Columbus; R. S. Zerke, Mathieson Chemical Corp., Baltimore, Md.; and B. F. Janson, Ohio State.

Sixth Row: J. Lewis Allison, N. Carolina State College; Carl J. Eide, Univ. of Minnesota; Lawrence Henson, Kentucky Agri. Experiment Station and T. C. Ryker, E. I. duPont de Nemours & Co., Inc., Wilmington, Del. Representatives of Canadian Department of Agriculture at Cincinnati meeting: (L to R): George F. Manson; Dr. Robert Jones, Science Service; H. L. Seamans; Alfred B. Baird; and W. E. van Steenburgh.

Seventh row: Dr. Helen Hart, retiring editor, discusses work with her successor, Dr. W. C. Price, Univ. of Pittsburgh, newly elected editor of "Phytopathology." Dr. L. Gordon Utter, Phelps-Dodge Refining Corp., New York; C. C. Jennings, General Chemical Div., New York; and J. L. Keil.

Eighth row: Dr. George L. McNew rises in acknowledgement of his being introduced by Dr. Horsfall (background) as new APS president at banquet. J. R. Wallin, Iowa State College, Ames; Dr. Paul R. Miller, Muriel J. O'Brien, U.S.D.A., Beltsville, Md. and L. H. Person, U.S.D.A., Raleigh, N. C.; all cooperators in the Plant Disease Warning Service, headed by Dr. Miller.



with Ten Other Fungicides in the Control of Turf Diseases" was the title of a paper presented by two Michigan State College plant pathologists, John R. Vaughn and William Klompars. They described as "excellent," the control obtained in plots sprayed with cycloheximide, two chromate compounds ("Crag 1025" and "Crag 531") and an organic cadmium compound "(Cadminate)." Good control was obtained in the plots sprayed with inorganic mercury ("Calo-clor") and an organic sulfur compound ("Vancide 51"), while fair control was accomplished by use of a phenyl mercury compound ("Tat-Clect"), a mixture of hydroxy-mercurichlorophenol and hydroxy-mercuricresol ("Special Semesan") and by thiram ("Tersan"). In another location on large turf plots sprayed with cycloheximide or with phenylmercury, the cycloheximide was completely effective for the control of melting-out caused by *Helminthosporium* sp. while the phenyl mercury did not check this disease at all.

J. D. Wilson, Wooster, Ohio, presented a paper, "Comparative Effectiveness in Control of Early Blight on Potato and Tomato of Differently Formulated Dithiocarbamates." He found that zinc dimethyl dithiocarbamate, (ziram), commonly used as a wettable powder, gave more effective control of early blight on potato and tomato when prepared from a slurry, and also when formed in the spray tank. Modifications of ziram in the form of zinc dimethyl dithiocarbamate cyclohexylamine (Zac) and as a half-and-half mixture of ziram and zinc mercaptobenzothiazole ("Vancide 51" plus $ZnSO_4$) were also more effective when prepared in the spray tank than when used as the reaction products in the form of wettable powders. Likewise, tank-mix zineb usually has given slightly better results than zineb used as a wettable powder in the control of early blight. However, manganese ethylene bis dithiocarbamate gave better results when used as a wettable powder (prepared by the manufacturer) than as a spray tank mixture. Chemical opinion seems to be that conditions can-

not be carefully enough controlled under casual field operations to insure a uniform product which will always be of maximum effectiveness in disease control.

That chemotherapeutic activity may be independent of the fungitoxicity of a compound was stated in a paper by David Davis, Connecticut Agri. Expt. Station, New Haven. He reported on a number of tests comparing the chemotherapeutic activity of a number of compounds against *Fusarium* wilt disease of tomato.

In the tests, both 120 micromolar sodium 2-carboxymethylmercaptobenzothiazole and 410 micromolar 2-(n-amy) pyridine had high chemotherapeutic activity, but only partially depressed mycelial growth at 5,000 micromoles per liter. The 75 micromolar 4-chloro-3,5-dimethyl-

phenoxyethanol and 86 micromolar n-octadecyltrimethylammonium pentachlorophenate were highly chemotherapeutic, and reduced growth at equivalent concentrations. A 2000 micromolar oxiquinoline benzoate had no chemotherapeutic activity, but 100 micromoles per liter inhibited mycelial growth completely.

Excepting oxyquinoline benzoate, inhibition by these compounds of oxygen uptake approximately paralleled their mycelial growth-inhibiting capacity. An aqueous extract of whole tomato plants grown for 6 days on 75 micromolar 4-chloro-3,5-dimethylphenoxyethanol was not fungitoxic when tested against spores of *Stemphylium sarcinaeforme*. However, macerated tissue from these plants exhibited approximately a 20 per cent increase in oxygen uptake and invert sugar content. 4-Chloro-3,5-dimethylphenoxyethanol may alter the susceptibility of the host to disease by causing pronounced changes in its metabolism.

In another paper, A. E. Dimond and Mr. Davis discussed the use of 2-carboxymethylmercaptobenzothiazole salts as chemotherapeutants for plant diseases. They reported that the alkali salts of this material are not fungitoxic in spore germination tests, nor are they changed to fungitoxic compounds by contact with living tissue. However, in controlled greenhouse experiments, soil applications of these compounds have markedly reduced the incidence of *Fusarium lycopersici* in the roots and of *Alternaria solani* on the leaves of treated tomato plants. In field experiments these compounds materially reduced the disease grade of *Verticillium* wilt of eggplant (8 per cent in treated versus 30 per cent in check plots) when applied five times at weekly intervals as a soil treatment to inoculate plants in heavily infested soil. They reduced the severity of Dutch elm disease when applied as a foliage spray with a non-phytotoxic oil. Such sprays were applied five times at weekly intervals and trees were then inoculated with *Ceratomyces ulmi*. Four weeks later the disease grades in the treated and con-

New Officers Named

Officers elected by the associations were announced at the Cincinnati meeting as follows:

AMERICAN PHYTOPATHOLOGICAL SOCIETY

President, Dr. George L. McNew, managing director, Boyce Thompson Institute, Yonkers, N. Y., to succeed Dr. J. G. Horsfall, director of the Connecticut Agricultural Experiment Station, New Haven.

Vice-president, George F. Webber, Gainesville, Fla., succeeding Dr. McNew.

Secretary, Dr. S. E. A. McCallan, Boyce Thompson Institute, re-elected.

Treasurer, Dr. E. A. Dimond, Connecticut Agricultural Experiment Station, re-elected.

Editor of "Phytopathology": Dr. W. C. Price, University of Pittsburgh, succeeding Dr. Helen Hart, University of Minnesota.

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

President, Dr. E. F. Knipling, Assistant chief, Bureau of Entomology and Plant Quarantine, U. S. Dept. of Agriculture, Washington, D. C., succeeding Dr. Roy E. Campbell, U. S. D. A., Alhambra, Calif.

Vice-president, H. G. Johnston, College Station, Texas, succeeding Dr. Charles E. Palm, Cornell University, Ithaca, N. Y.

Secretary-treasurer, Dr. Ernest N. Cory, University of Maryland, College Park, Md., re-elected.

trol plots were, respectively, 6.2 and 32 per cent, while 8 weeks later they were 12 and 58 per cent. Spraying therapeutants on elms is much easier and cheaper than soil application and makes possible the treatment of many city trees that are surrounded with pavement.

Tuesday afternoon, a section on nematology and soil treatments was held, with E. J. Cairns, U.S.D.A., as chairman. E. M. Cralley and R. G. French, Arkansas Agri. Expt. Station presented a paper on "Control of White Tip of Rice," stating that the nematode, causing the disease is carried over primarily in the seed. Significant decreases in the severity of the disease have been obtained with the following seed treatments: (1) Parathion dust (25 per cent) and "Systox" on Carbon dust (50 per cent) at the rate of 2 oz. per bushel; (2) 12-hr. soak in a 1:1000 aqueous solution of mercury bichloride; (3) methyl bromide fumigation at the rate of 1½ lb. per 1000 cu. ft. of space; and (4) "Aagrano" dust at the rate of 2 oz. per bu. Methyl bromide fumigation slightly retarded seed germinating when the moisture content of the rice seed was above 13 per cent. Aagrano dust and mercury bichloride soak treatments caused some mercurial toxicity.

Colloquium Held

FIVE new fungicidal products were introduced by four company representatives at the Fungicide Colloquium held Tuesday night, following the Phytopath banquet. Dr. L. Gordon Utter, Phelps Dodge Refining Corp., New York, was chairman of the session which was attended by more than 200 persons.

Carbide & Carbon Chemical Co., division of Union Carbide & Carbon Corp., New York, represented by Dr. John Harry, introduced its experimental fungicides designated as numbers 5379 and 5400. Research quantities of each material are available for experimental evaluation, Dr. Harry said, but neither material is for sale. The chemical name for Experimental

fungicide 5379 is 1,2,3-trithia-5,8-diazacyclononane - 4, 9 - dithione; while #5400 is designated as alpha, alpha-trithiobis (N-dimethylthioformamide.)

It was stated that both preparations have similar chemical, physical and biological properties; they are not specific and have given control of a wide variety of plant diseases. No. 5400 shows promise as a seed treatment fungicide. Lack of phytotoxicity to many crop plants is listed as another feature and the materials present no unusual hazards, according to preliminary toxicology.

R. T. Vanderbilt Co., Inc., New York, presented its product, "Vancide 51" at the Colloquium, Dr. Kenneth Parsons described the material as being a water solution of the sodium salts of dimethyl dithiocarbamic acid and 2-mercaptobenzothiazole with a total of 30 active ingredients. The liquid product is generally more useful in agriculture than is the dry product, he said. Moreover, to dry "Vancide 51," an additional step in manufacture is required.

Used in slurry treaters, the product has a number of advantages, the colloquium was told. No water needs to be added, no tank agitation is needed and there is no clogging of pump, drainage lines or slurry cups due to settling. Neither is there any abrasion of moving parts.

Aside from use as a seed protectant, "Vancide 51" was said to be valuable as a foliage spray, soil drench, seed piece dip and surface disinfectant.

Toxicological data indicate an LD50 of 7,600 mg./kg. in rate, with the LD100 in rate set at more than 10,000 mg./kg. Chronic toxicity tests at the highest level (5,000 ppm) incorporated in the diet of test animals, show no adverse effect on food intake, growth or blood in dogs and rats after more than a year of continuous feeding, the report stated. Human patch tests have indicated no skin irritation on persons ranging in age from 10 to 74 years.

Designated as "Velsicol Compound 50-CS-46," a new highly chlorinated organic mercury compound was introduced by Velsicol Corporation, Chicago, Ill. It is said to be effective against many fungi; can be used as a seed treatment for prevention of seed decay and damping-off; control of cotton anthracnose and for control of barley strips.

Chemical and physical properties described at the colloquium included its being an almost odorless, white, crystalline solid of high molecular weight (ca. 600), with a melting point of 190-192° C. It is readily soluble at room temperature at concentrations of ten percent or more in acetone, methyl isobutyl ketone, isophorone, and other ketonic solvents, moderately soluble in alcohols, slightly soluble in hydrocarbons and substantially insoluble in water.

Research quantities of "Compound 50-CS-46" and its formulations will be made available to qualified investigators upon request to the Velsicol Corporation, it was stated.

E. I. duPont de Nemours & Co., Inc., Wilmington, Delaware, introduced a new manganese ethylenebisdithiocarbamate fungicide, called "Manzate." The new material was said to be particularly effective against certain fungus diseases of tomatoes and potatoes, and is being recommended in 1952 for early blight, late blight, anthracnose, gray leaf spot and Septoria leaf spot in tomatoes; and for both early and late blight on potatoes.

Preliminary studies indicate that the toxicity of "Manzate" is of the same order as that of ferbam for a lethal dose; namely, 7500 mg./kg. of body weight, in rats.

Residues on tomatoes, celery and potatoes indicate that "Manzate" may be similar to those of zineb, the data sheet indicated.

"Manzate" fungicide is expected to be available for limited sales in the 1952 season, the company states.

Lea S. Hitchner, executive secretary, National Agricultural Chemicals Assn., Washington, D. C.,

was scheduled to appear on the colloquium program, but could not be present. In his place, the chairman, Dr. Utter, talked briefly on the present state of Federal Legislation as it affects the pesticide industry.

Henry H. F. Smyth, Jr., Mellon Institute, Pittsburgh, presented a paper on the toxicology of fungicides. He explained that toxicological study starts with the presumption that the fungicide will injure humans if it is contacted, absorbed or ingested in excess of some

unknown amount. No exception to this presumption has yet been found, he said, and pointed out that experiments upon warm-blooded laboratory animals act as a guide as to the amount of toxicant which might be ingested with safety. Two factors, the injurious amount and the nature of injury, constitute the toxicology of the fungicide, he said.

"No amount of toxicological study will of itself yield a decision on the question of the safety of the
(Turn to page 109)

made by Dr. J. T. Sanders of the National Grange, calling for the creation of a "National Pesticide Commission," which would be composed of a physical scientist from the Agricultural Research Administration; a scientist from the U. S. Public Health Service and another from the Food and Drug Administration.

Function of this group would be to determine policies and decisions as to research needed to test a new product; to pass on the safe and economically sound use of new chemicals; and to set tentative and final tolerances.

In addition to the Commission, it was proposed that a Food Industry Advisory Committee should be set up to advise with the Commission. This committee would be composed of representatives of the American Medical Association; the American Veterinary Medical Assn.; the pesticide manufacturing industry; food processing industries; farm food producing groups; land grant colleges and farm organizations; farm marketing groups and consumer groups.

Mr. LeClerc went on, however, to review the testimony of other witnesses who objected to the classifying of pesticides as chemical additives, and who declared present legislation adequate to protect the public fully against improper use of pesticides. Mr. LeClerc urged his hearers to read the complete testimony of witnesses such as Dr. F. C. Bishopp and Drs. W. J. Hayes and Paul A. Neal of the U. S. Public Health Service who presented extensive discussions on the use of DDT and its effect on human health. He also called attention to the testimony of Drs. Frank Princi, University of Cincinnati; Charles E. Palm, Cornell University; and George C. Decker, Illinois Natural History Survey. Dr. Decker was quoted as having stated:

"The past record of pesticide usage is apparently not bad. Despite the use of millions of pounds for pesticidal chemicals annually for

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AAEE Concurrent Sessions

CONCURRENTLY with the Phytopaths, the American Association of Economic Entomologists was holding its 63rd annual meeting in the Netherland Plaza. Several joint sessions attracted large representation from not only the AAEE and the APS, but the Entomological Society of America and the Potato Association of America, also meeting at the same time.

The first such joint meeting, held Monday evening, was under the chairmanship of H. B. Petty, Illinois Natural History Survey, with H. B. Fisher, Univ. of Wisconsin, Madison; and L. C. Weaver, U. of Maryland, secretaries.

Dr. E. L. LeClerc, Agricultural Research Administration, U. S. D. A., Washington, D. C., discussed in detail the history of the Delaney Committee, reviewed much of the testimony presented to it during the 16-month life of the committee in a talk, "Proposed Legislation Dealing with the Use of Pesticides." Mr. LeClerc recalled the report submitted by the committee early in 1951, in which it declared that according to the consensus of witnesses, "a section generally similar to the New Drug Section of the Federal Food, Drug and Cosmetic Act should be added to the statute which would require proof of safety before a chemical or synthetic is permitted to be used in or on food products."

Legislation has been proposed

to cover this situation which Mr. Delaney and his committeemen apparently believe to be necessary. One such proposal, submitted by Congressman Miller of Nebraska, (HR 3257) would amend the Federal Food Drug and Cosmetic Act by providing for the regulation of chemical additives in food. Such an "addition" was defined in the bill as "Any substance . . . intended to be used to preserve or alter any food or any characteristic thereof, or in substitution . . . for any ingredient . . . or as a pesticide or other purpose in producing, processing, packing . . . if such use is likely to result in contamination of such food, which substance is not generally recognized among experts . . . as having been adequately tested to show that it is not poisonous or deleterious, or if it is poisonous or deleterious and is intended for use where a poisonous or deleterious substance is required in the production of food, that it is not so recognized by such experts as having been adequately tested to show that it is safe for such use."

This bill would require, said Mr. LeClerc, that a person must submit to the administrator full reports of toxicological investigations, and complete descriptions of methods of analysis for the quantitative determination of such chemical additive . . . "including animal and plant tissues if stored therein."

Another proposal has been

**Twenty Million ton year seen
for 1951 consumption of**

FERTILIZER

By

John F. Gale

Statistician.
National Fertilizer Association
Washington, D. C.

BASED on preliminary figures furnished by the 28 states where farmers last year used more than 78 percent of all the fertilizer and fertilizer materials applied to the crops in the U. S., it is probable that 20,100,000 tons, or more, of commercial fertilizer will be consumed in the U. S. during the fiscal year ending June 30, 1951. (These figures include gypsum, phosphate rock and soil amendments, of course.) If the projected figures prove true, this will be the first time in history that consumption of 20 million tons of fertilizer has been achieved in the U. S.

The indicated record consumption is 11.7 percent greater than the 18 million tons shipped during the preceding 12 months and it is well over double the 9 million tons of fertilizer used only a decade ago.

It can be expected that the plant food content of a ton of average fertilizer was about 23.00 percent, the same as it was during the

previous fertilizer year. If this proves to be true, more than 4.6 million tons of N-P-K were used in the last fertilizer year; more than one-half million tons greater than in the preceding 12 months.

North Carolina again used more fertilizer than any other state. Tax tag sales reports show that 1,838,500 tons of fertilizer were used in this state last year compared to 1,740,348 tons the year before, an increase of 5.6 percent. Georgia with tag sales and reports of shipments equivalent to 1,297,764 tons and Florida with 1,182,167 tons were second and third respectively.

Estimated consumption of all commercial fertilizer in the 17 states comprising the Southeastern quarter of the United States was about 10.9 million tons in the past fiscal year, a million ton increase over the preceding 12 months. Undoubtedly the huge 1951 cotton acreage was one of the main factors contributing to this increase.

Distribution of the increased consumption appears to be fairly uniform. Of the 25 reporting states upon which this estimate is based, only Alabama, Massachusetts and West Virginia showed decreases and they were slight. As a group, consumption fell 4.4 percent, from 1,333,123 tons in 1949-50 to 1,273,931 tons in 1950-51. Indiana and California reports show consumption increases of 149,267 and 380,335 tons respectively; likewise, Missouri farmers used a quarter of a million tons more in 1950-51 than they did in the previous year.

The current shortage of sulfur for agricultural use—primarily consumed in the manufacture of superphosphate—almost precludes the possibility of any increase of comparable size during the current 1951-52 fiscal year. In all probability, fertilizer consumption will remain fairly stable until the supply again outdistances the demand for sulfur.

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Agricultural Uses for

MALEIC HYDRAZIDE

Figure 1. The synthesis of Maleic hydrazide.



MALEIC hydrazide was first synthesized in 1895 by Foersterling¹ but it was 1949 before the possibility of using the compound for agricultural purposes was initiated by the report of Schoene and Hoffman². Although several salts of maleic hydrazide have been prepared and used, the most common formulation has been the water soluble diethanolamine salt containing 30 percent maleic hydrazide by weight³. One of the most notable results associated with application of

the material to plants is that it often causes a temporary suspension of stem elongation. Subsequently the plant may resume its ordinary behavior. These results are relatively unique among growth regulators and, coupled with other responses, proffer many practical applications which have been investigated. An unusually large volume of research has been performed with maleic hydrazide in the past two years and this article summarizes the facts to date.

Toxicity

WHEN a chemical is to be used on plants which may be consumed by humans or livestock, its possible toxicity hazards are of immediate concern. In the case of maleic hydrazide, it is not irritating to the skin nor toxic by oral ingestion in the amounts likely to be used on plants. An accurate analytical procedure has been developed for measurement of the material in biological tissues and at least the worker has reported that the material did not corrode metals ordinarily used in spray machinery.

Maleic hydrazide apparently is absorbed by almost all plant tissues, including roots, but its general application has been as a spray. Maximum response requires the addition of a



The Irish Cobbler potatoes at the left were from plants which had been sprayed with 2500 ppm of maleic hydrazide 6 weeks before harvest. On the right side are non-treated potatoes. (Photos by Dr. S. H. Wittwer, Michigan State College.)

By

David G. White

Professor of Pomology
Pennsylvania State College,
State College, Pa.

wetting agent. According to the manufacturers, the material is absorbed by leaves in about two days and it has appeared that a sticker might be worthwhile to prevent loss by heavy dew or rain the first few days following application.

Other investigators have demonstrated that maleic hydrazide reduces the rate of plant respiration through partial inactivation or inhibition of one or more of the dehydrogenases, which are enzymes active in the respiration cycle. The decreased rate of respiration is associated with inhibition of mitosis (ordinary cell division) and consequent growth of the plant. These results suggest that the material antagonizes auxins, the hormones synthesized naturally by plants, and therefore ma-

leic hydrazide may be referred to as an anti-auxin or auxin competitor. If it is applied in concentrations specific for different plants, the reduction in rates of respiration is only temporary.

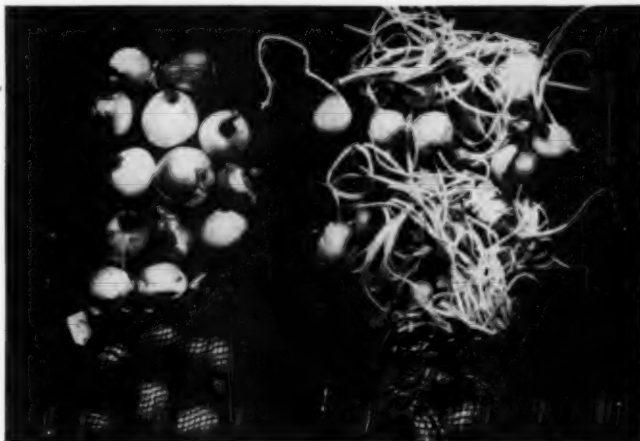
It has been found that sucrose and starch accumulate in the leaves of treated plants to a great degree probably because the sieve tubes collapse following treatment with maleic hydrazide. With this in mind it is not surprising to find that leaves often thicken due to cell enlargement (not cell division). It is also common to observe a transient intensification of the green color in leaves which may be accompanied

or followed by a localized accumulation of anthocyanins.

Other phenomena which have been observed on various plants treated with maleic hydrazide include the apparent narrowing of leaves and sometimes the occurrence of obvious wilting. In some instances, death of the root tips and interference with water absorption occurs, causing a wilted appearance of the leaves. With certain plants, treatments have been found to cause total sterility, temporary sterility, or male sterility. And last, but of considerable importance is the fact that certain concentrations of maleic hydrazide quite often result in leaf and/or bud abscission. All of these characteristic effects vary with (a) the concentration of maleic hydrazide used, (b) the presence or absence of a wetting and/or sticking agent, (c) differences in age of the plants when they were treated, and (d) differences in environmental conditions. These variations probably account for the lack of complete agreement on the effects of the compound as reported by more than a hundred investigators.

Although little literature is available, maleic hydrazide has been reported to act as a systemic fungicide against certain species of *Alternaria*. It also has been reported to act as a bactericide in preventing gall formation by a *Phytophthora* species on tomato plants. In this same

Brigham Yellow Globe onions at left of photo were from plants sprayed with 2500 ppm of maleic hydrazide two weeks before harvest. On the right are non-treated onions. (Photo by Dr. S. H. Wittwer, Michigan State College, E. Lansing, Mich.)



category probably, application of maleic hydrazide to bush beans was found to suppress nodule formation.

More trials have been made with the material for use as a herbicide than for any other purpose. In reviewing the reports by the various research men who have attempted to control weeds or grass with maleic hydrazide there is considerable disagreement from one extreme to the other. Some workers have reported the material to be absolutely useless as a herbicide while other workers have advanced the possibility of the material as a selective herbicide.

Undoubtedly the reason for this great variation in results is due to the difference in the manner in which the experiments were conducted. For example, if one investigator applied a relatively dilute concentration of maleic hydrazide to rather mature plants without the use of a wetting agent and/or sticker, it is likely such plants would be affected only temporarily if at all. On the other hand, another worker may have applied the same material at a much higher concentration using a wetting agent and/or sticker on relatively young plants and obtained promising results. It seems that there are a sufficient number of reports which fall in the latter category of promising results that we might be foolish to eliminate the possibility of maleic hydrazide as a herbicide until more extensive tests have been made in a manner conducive to desirable results.

In general, pre-emergence treatments with the material have not been successful and it seems likely that its successful use as a herbicide will be on quite young plants. The following weeds have been controlled relatively well with 4 to 8 pounds per acre of maleic hydrazide; wild oats, green foxtail, red root, foxtail, Johnson grass, water grass, mustard, barley, Russian thistle, stinkweed, quack grass, wild onions, knotweed, devil's shoestring and nutgrass.

In some instances, the weeds recovered after a period of inhibi-

tion. If they were treated with maleic hydrazide and a few days allowed to pass for the material to be translocated to the roots, the destruction of the above-ground parts by use of herbicidal oils or by cultivation seemed to be quite promising as a method of controlling or eradicating the weed. One should keep in mind that maleic hydrazide as a herbicide is most effective with young plants and that the treatment of the same plants when they are older and larger may result in little if any herbicidal effect.

A second important use for maleic hydrazide has been studied sufficiently that it seems ready for practical application on a wide scale. This involves its use as an agent to prevent sprouting and decrease respiration rates of certain stored crops. For example, great losses occur in the storage of potatoes, onions, carrots, sugar beets, and similar plant parts. Although treatment of potatoes with maleic hydrazide after harvest prevented their later sprouting when the non-treated potatoes did sprout, a better method has been developed. This method consists in spraying the potato plants with 2500 ppm of maleic hydrazide 2 to 6 weeks prior to harvest. As a result, the harvested potatoes do not develop sprouts under ordinary storage conditions.

Similar results have been obtained with pre-harvest sprays of maleic hydrazide on onions and carrots and on other crops like rutabaga, turnips, and garden beets. In addition to preventing the sprouting of such plant parts, maleic hydrazide treatments also have resulted in a decreased rate of respiration. A decreased rate of respiration assumes great importance in the storage of sugar beets, for example, because ordinarily they lose a considerable sugar content due to respiration if they are stored over a long period of time.

In a similar way, internal decay of lettuce caused by high rates of respiration has been reported to be prevented. There also is evidence to suggest that this material may

be used for the same purpose with fruits and, although little research has been reported concerning its use on cut flowers, until proved otherwise the possibility exists that maleic hydrazide might prolong the beauty of cut flowers to an advantage.

A third use for maleic hydrazide occurs in instances where it is desirable to have a temporary growth inhibition. For example, one of the early tests with the material was to inhibit the development of a *Pyracantha* hedge in order to decrease the number of clippings¹. With the *Pyracantha* hedge and similar rapidly growing hedges it is advantageous to spray them with maleic hydrazide prior to clipping and thereby temporarily inhibit future growth. A similar use has been demonstrated on lawn grasses around the home, on golf courses, and in parks or other public institutions where cutting the grass is an expensive task. Another instance where the temporary inhibition of grass growth has been shown to be desirable is in orchards. Many orchards follow a sod system of culture that has proved most successful in areas susceptible to soil erosion. Although the sod effectively reduces erosion, it also competes with the trees for soil moisture, particularly during times of dry weather. One investigator found that it was advantageous to spray the orchard sod with maleic hydrazide in order to inhibit its growth temporarily, rather than to mow the grass as is done customarily. The concentrations useful for the above purposes need to be established by further experiments.

Growth Suspension

THERE are instances where a temporary suspension of growth of other crops may be worthwhile. For many years, horticulturists have attempted to devise a simple method to produce semi-dwarf apple trees which would grow no more than 15 to 20 feet in height. Orchard operations would be facilitated greatly with such semi-dwarf trees in com-

¹ Knott, J. E. Report made on plant growth inhibitor. Agr. Chem. 5 (2): 55-55, 1950.

parison with ordinary trees 30 feet or more in height. Attainment of this goal seems likely with treatments of maleic hydrazide according to a recent report. Four-year-old Northern Spy apple trees were sprayed with the compound in the spring for two consecutive years. Usually these applications were made after the current season's shoots had developed 4 to 6 inches in length. One application of about 2000 ppm caused a complete or temporary loss of apical dominance. Following this temporary inhibition quite often a few shoots grew from lateral buds a relatively short distance back of the terminal bud on the current season's shoot. The overall effect of these treatments has been to dwarf the trees in comparison with non-treated adjacent trees. If these trees continue to develop in the usual manner except for being dwarfed, it will constitute an easy way around the difficulties associated with producing desirable semi-dwarf trees on special rootstocks.

The inhibition of strawberry plants by treatment with maleic hydrazide may be advantageous with certain varieties which develop an excessive number of runners the first year. Under such conditions, if the number of runners could be curbed, then the yield of berries in the following season would be increased. Maleic hydrazide can be used to inhibit the development of runners, but definite concentrations for this use have not yet been established.

The possibility of using maleic hydrazide on fruit plants to delay their blossoming a few days in the spring is of great interest. Flowers or young fruits are killed so often by frosts that researchers hoped to counteract such unfavorable weather through temporary inhibition of flowering with maleic hydrazide. This was accomplished with brambles like red and black raspberries. If they are sprayed with 50 to 500 ppm plus a wetting agent when the leaves are about the size of one's fingernail, then further vegetative growth will be inhibited temporarily. The period of inhibition, about 7 to 14 days, will

be reasonably proportional to the concentration used. When this period of inhibition is over, then the shoots will resume growth and develop flowers. Maturation of the fruit will be delayed about the same period and this prolongation of the harvest season by the treatments can be helpful to the grower. Ordinarily brambles are not caught by frosts, however, and the delay in blossoming per se has little value.

Many ways of using the compound on tree fruits to delay blossoming have been tried without success. Sprays and limb injections at various times of the year have not resulted in favorable results. The difference in effects on the flowering of brambles and of tree fruits may be explained on the basis of their different fruiting habits. In brambles, flowering is preceded by vegetative growth which is inhibited by maleic hydrazide. In tree fruits the flowers are differentiated over the previous seasons and open rather independently of vegetative growth and are not favorably inhibited by maleic hydrazide. Nevertheless, the importance of the problem to fruit growers warrants continued investigation with this and similar materials.

There are a number of miscellaneous uses of maleic hydrazide that may become important and seem worthwhile to mention at this time. In the production of hybrid corn, for example, a considerable amount of hand labor is involved in removing the tassels of the pistillate parent plants. Sprays of maleic hydrazide applied about the time the tassel has just been differentiated result in a male sterile plant. This statement needs qualifying, because thus far some viable pollen grains have always developed later and in most instances the injury to the plant is so severe that the treatment may not be practical. In all cases, the yields of corn from plants treated with maleic hydrazide in this manner were reduced. Nevertheless, it is possible that a treatment of this nature with maleic hydrazide or some other similar material may be employed by plant

breeders as a faster and more economical method of emasculation.

A related use for maleic hydrazide is to prevent the formation of undesirable fruits on certain ornamental plants such as the Ginkgo. The fruits of the Ginkgo develop an obnoxious odor and limit the value of this tree for use in landscape designs. Sprays of the compound applied at the time of flowering cause them to drop their flowers or small fruits. Various concentrations need to be tested in order to determine the amount adequate to eliminate fruit without injuring the tree otherwise.

The use of the material also may become important to growers of Turkish tobacco. It is customary to cut the tops of tobacco plants prior to harvest in order to avoid development of flowers. The topping, however, usually induces the production of suckers from auxiliary buds and these suckers also are not desired. Sprays of maleic hydrazide about the time tobacco plants are initiating flower buds have been found to stop elongation of the stem, to inhibit the flower buds, and to prevent the production of suckers. Following these effects the top leaves of the plants become as large as the lower leaves. Concentrations for this use apparently range from 500 ppm and less. Somewhat similar important effects were found with head lettuce, where bolting is undesirable. Sprays of about 1,000 ppm two weeks prior to harvest prevented bolting as well as reducing the occurrence of internal decay. It is likely that the material would prevent bolting of other crops.

A rather new field of study concerns the use of maleic hydrazide in combination with other materials, particularly of hormone nature. From evidence available, it appears that antagonistic or synergistic effects in combination sprays sometimes may occur to an advantage. For example, the addition of maleic hydrazide to a spray of 2,4,5-trichlorophenoxy propionic acid apparently reduces the rate of respiration of apples. Without the addition of maleic hydrazide,

(Turn to page 111)

Toxicology and Hazard Record of the newer

PESTICIDES

SINCE early time, man has waged a continuous battle to protect and maintain himself and his food supplies in a fiercely competitive environment. Frequently even the tools and materials employed in earning his livelihood have proved dangerous to him. As technological advances have been made and as civilization has become more industrialized, health and safety have been threatened by the very processes that have succeeded in producing abundance and higher standards of living. During the past two decades, described as the "chemical age," industrial change has been characterized by the development of a tremendous number of new chemical compounds which have produced ever-changing environmental hazards. Frequently, little is known concerning the toxicity of these substances and still more often, much is recorded as fact which in reality is mere opinion. It is no wonder, therefore, that serious concern and even alarm are common among users. The publication of many ex-cathedra statements which predict dire consequences has done much to promote fear but little to encourage safe practices.

The very adjectives "toxic" and "non-toxic" are used so carelessly as to produce unnecessary concern or a false sense of security. It is axiomatic that no substance is entirely harmless or completely unsafe in any concentration and under all circumstances. For example, the ingestion of sugar is dangerous for the diabetic, common salt must be removed from the diet of the cardiac patient,

and yet even strychnine may be used with safe therapeutic effect when the dose is small. Therefore, it would seem to be more realistic to consider materials from the point of view of their pharmacologic action in the negative sense only, and from the point of view of physiologically harmless dosages in the positive sense. Thus a substance can be regarded as toxic from the former point of view and yet relatively innocuous for normal use.

Evaluating Pesticides

ONE important group of chemicals, the agricultural pesticides, require this type of evaluation. The great bulk of knowledge concerning the toxicology of the new pesticides is largely the result of animal experimentation. But the application of this information to humans is precarious and often may be misleading.

Consider for a moment how this type of data must be obtained. To determine non-injurious concentrations of a chemical, groups of animals (and most often groups of not more than ten for each concentration) are kept on a certain dosage schedule for periods of from one to two years. During this period, only a few observations can be made which are of physiological importance. These studies may include the examination of the circulating blood, the analysis of excreta or the performance of certain simple functional tests for which normal base lines rarely exist. Following the prescribed period of exposure, the animals are examined by the usual

histological methods for evidences of aberrations of normal tissue structure.

What is "Normal"?

SUCH a procedure would appear to be simple and sufficiently straightforward as to allow for little argument or difference of opinion. The unfortunate fact is that we do not know with what to compare our findings. We lack normal criteria. There are no standards with which animals who show apparent changes can be compared. Consequently, the conclusions which are advanced by various investigators frequently differ. Experimental animals harbor parasites and micro-organisms which often lie quiescent for long periods but which may be activated, or whose action may be modified when the body is subjected to stress. The obvious difficulties posed by these facts are not the only hindrance to reliable information.

Other equally important factors cannot be disregarded. Rats, mice, rabbits or dogs seem to have no difficulty or objections in eating precisely the same diet day after day and year after year. But we do know the optimum or even desirable components of such a diet. We cannot estimate the adequacy of its quality and quantity in physiological terms. Is it sufficient to maintain these animals in good condition but perhaps more susceptible to the stresses which are imposed by the addition of a foreign material to their food? Or would it be more accurate to allow the animals to choose their own food, some of the

by
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components of which might provide protective mechanisms? Are their detoxification mechanisms superior or inferior to those found in humans?

None of these questions have ready answers and Barnes of the British Medical Research Council has concluded: "In the absence of adequate information about the normal animals and with the knowledge that the experimental material is subject to a number of extrinsic diseases . . . the interpretation of tissue changes in animals at the end of a long experiment will never be easy or possible at all."

The validity of this observation is borne out by the experience which has been accumulated with a variety of substances. Nitrogen trichloride has been shown to be injurious to dogs but no harmful effects have ever been shown in human beings. Conversely, early work on the effects of beryllium and its compounds on animals incorrectly indicated that the beryllium ion was non-toxic. The beryllium experience has brought forth still other important lessons. In the manufacture of beryllium steel a certain amount of dust, consisting of sodium silicofluoride, beryllium oxide, and beryllium fluoride is continually given off. Since only the dust of beryllium fluoride was toxic to animals, it was immediately decided that the acid radical was the toxic fraction.

Human Cases Different

THE appearance of human cases, however, produced undeniable evidence that animal investigators had been misled. In 1949, Aub and

Grier reported seven cases of acute pneumonitis in metallurgical workers who had been exposed to the dust and fume of pure beryllium metal and beryllium oxide. The occurrence of these cases supports the opinion that the beryllium ion is the toxic fraction although no one has yet produced pulmonary berylliosis in animals by any method of administration. More recently, English workers have shown that rats may live without apparent difficulty when huge quantities of Welsh coal are introduced into their lungs, but unfortunately many Welsh coal miners cannot.

If animal investigation may be often unsatisfactory and frequently unreliable, how can we understand with any degree of accuracy the hazards which are associated with the use of the newer pesticides? It is obvious that in the production of any new material, a group of individuals must be employed to develop, manufacture and exploit the compound. In addition, there will be carelessness in handling despite all precautions and frequent suicide attempts will occur.

Such a group of persons, therefore, represents a ready-made series of subjects for investigation and study. Then the records of these individuals, when available, are worthy of careful scrutiny and serious evaluation, particularly since the amount of absorbed material is usually known or can be determined. These records should furnish infor-

* Paper delivered at joint session of American Association of Economic Entomologists and American Phytopathological Society, Netherland Plaza Hotel, Cincinnati, Ohio, December 12, 1951.

mation which is of inestimable value in determining whether or not safe usage is a practical term with respect to any particular substance.

The amounts of pesticidal materials which have been employed during the past fifteen years are tremendous. Any expression of the relative quantities which have been used would be invidious and without purpose in this discussion. Suffice it to say that many millions of pounds of rodenticides, fungicides and insecticides have been manufactured and distributed. In some instances, the use of these materials has been carried out with caution but in the majority of cases only minimum safeguards have been observed. This very carelessness is important with reference to the absorption of these chemicals and the number of cases of poisoning which have been reported. Under these conditions, one would expect the record to show an exaggeration of the hazards rather than an underestimation of true toxicity.

Such is not the case when objective interpretation is devoted to the study of the incidence of intoxications as compared with practical usage. Our problem is not whether or not poisoning can be produced by the administration of sufficient quantities of a material, since there is no truly non-toxic substance. The question is in fact, what hazard is present during the normal application of a pesticide when it is applied in effective quantities and used with ordinary precautions?

The most critical studies of actual use records of the various pesticides do not reveal information that should make one feel that these compounds cannot be employed with comparative safety both to the user and the general public. A complete review of the various materials and their toxicologic activity is not possible but a consideration of the general groups of these substances provides little information which is worthy of causing national alarm.

Perhaps the most toxic of the newer pesticides are that group which are known as the organic



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phosphorus compounds. In common with many other insecticidal materials, these substances may be absorbed through the skin, respiratory tract, conjunctive and gastro-intestinal tract. Up to September, 1950, about two hundred cases of poisoning by HETP, TEPP and Parathion had been reported. Of these, only eight individuals failed to recover. Most important is the fact that the majority of these occurrences were the result of careless handling and indifference to ordinary precautions and were, therefore, considered accidental in character. This record is very similar to earlier experiences with more familiar and highly toxic materials such as nicotine and cyanide. There is no evidence at the present time that any of these compounds when used in the recommended concentrations will result in a residue problem to the consumer. Since these substances are readily hydrolyzed in the presence of water, it can be expected that the question of residue toxicity will not become serious.

A recent study of a group of pilots spraying tobacco fields with parathion indicated that with proper regard for standard methods, even an extremely hazardous operation can be carried out with relative safety. Because it was necessary for these pilots to fly at very low levels, it was essential that they remain in excellent physical and mental condition. Each man worked for from 8 to 10 hours a day and sprayed a solution of 25 per cent technical parathion in xylene and spraying took place from April 11 to June 29. Because the exposure was relatively great, red cell cholinesterase activity was determined at regular intervals. At the end of the season, none of the pilots had developed any evidence of inorganic phosphate intoxication and in only one case had the cholinesterase activity level change been sufficient to warrant discontinuance of the exposure. This experience demonstrates that even a relatively dangerous type of exposure can be controlled adequately and without deleterious consequences.

Fungicide Toxicity

THE hazard record of the fungicides has been made somewhat obscure by the fact that most of these substances contain materials which from experience are known to be either highly toxic or relatively innocuous. This presumption might well be valid were it not for the fact that toxicity is influenced not only by different compounds of an element but also by the different physical forms of the same compound. In general, however, the available evidence does indicate that the sulfur and copper fungicides are the safest in all respects. The quaternary ammonium derivatives are more toxic, at least experimentally, but clinical evidence does not suggest any remarkable use hazard.

Perhaps the most obvious hazard is in the use of the newer organic mercury compounds. The complaints of workers who are exposed to these materials indicate the typical symptomatology which is produced by the absorption of mercury. Although definite poisonings have been reported, these have been mostly accidental in character and fairly well identified as to dose of the material and clinical course of the illness. It is significant, however, that chronic exposure produces a readily recognizable series of symptoms characterized by a brassy taste in the mouth, loss of appetite, and various stomach disturbances. Early recognition of the cause of the complaints makes the presence of a hazard detectable and control of the exposure more easily attainable. From the point of view of danger to human beings, it is important that these materials can be and are being used without harm to the workers in many instances.

The third large group of pesticidal materials is composed of the chlorinated hydrocarbon insecticides. Because of their very newness and relatively common use, these have produced more controversy and differences of opinion than any of the other materials. Available records indicate that cases of poisoning have been attributed rightly or

wrongly to the use of most of the commercially available substances of this type. It can be anticipated that in the future, as greater quantities of these materials are used, more cases of poisoning, both real and suspected, will be reported. The expected experience probably will be no easier to evaluate in coming years than it is today. One can be certain that many bonafide cases will not find their way into the scientific literature and in spite of the absence of adequate histories of exposures, definite symptomatology and specific relationship to the absorption of adequate quantities of chlorinated hydrocarbons, a great number of illnesses will be recorded as proved intoxications.

Regardless of this past, present and future confusion, however, certain clinical facts can be assessed from the large mass of material which has been reported. Little argument exists concerning the fact that the absorption of large quantities of all the materials of this type will result in definite clinical signs and symptoms of intoxications. Much of this information has been obtained because of the fact that a sufficiently large segment of our population has been so determined in its pursuit of self-destruction (either accidentally or intentionally) as to provide us with adequate data concerning the physiological effects of the absorption of effective quantities of the chlorinated hydrocarbons. Since the most readily available compound will be the one which is most commonly employed, the literature is replete with cases of DDT poisoning.

Perhaps the most objective attempt to tabulate the reported cases of DDT poisoning has been made by the Committee on Pesticides of the American Medical Association. The report of this committee on March 10, 1951 tabulated a grand total of 384 reported cases of poisoning due to DDT and its formulations; and of these, 14 were fatalities. It is significant, however, that 74 per cent of the total number of cases and 12 of the deaths were

(Turn to page 97)

Steadily Rising Totals Mark

Fertilizer Use in California

AN increasing number of inquiries for data on usage and distribution of fertilizers in California, has been received by the State Bureau of Chemistry during the past few years. The information is usually sought to provide a basis for estimating future markets for these agricultural chemicals. What types of fertilizer or what forms of plant food are used on various crops? In what parts of the state is the material used? What is the potential volume of business in future years? These and other questions are included in the inquiries.

The three charts shown here give some of the available information on the subject, but comparison of California data with those of other states or of the United States is complicated by the fact that some states include the tonnage of manures, gypsum and other agricultural minerals in their fertilizer figures. Unfortunately, information on usage of fertilizer by county or by region is not available from any source.

Chart 1 shows that during the 25 year period from 1925 to 1950, national usage of fertilizers increased from 7 million tons to 18 million tons. During the same period, consumption of fertilizers in California rose from 90,000 tons to 640,000 tons. This means that while national usage increased $2\frac{1}{2}$ times in the quarter-century, California's

consumption increased seven times.

In percentage of national tonnage sold in California, the figure rose from about 1% in 1925 to almost 4% last year.

Of interest, too, is the fact that commercial fertilizer tonnage in California closely parallels the total farm value of the major crops produced in the state. A graph line showing the increase of crop value from less than \$500,000,000 in 1925 to $1\frac{1}{2}$ billion in 1950, runs almost exactly the same as the line indicating increases in fertilizer tonnage from 90,000 to 640,000 tons as mentioned above.

In former years, more than half of the annual tonnage of fertilizers in California was sold during the first quarter of the year. This is still the pattern of sales in many other states, but in California, the fertilizer programs on diversified crops and increased use in side dressing now require supplies of fertilizer throughout the seasons.

Mr. Rollins' presentation at the recent California Fertilizer Association meeting in Fresno, consisted of a series of charts, including the three on page 49, projected on a screen. This article summarizes the material contained in the presentation.—Ed.

Mixed fertilizers have constituted between 25% and 30% of the total tonnage at present, and over the period of the past quarter-century, averaged about 38%. Ammonium sulfate and superphosphates are providing an increasing proportion of the total tonnage.

As to the various forms of fertilizer sold in the state, it is revealing to see how use of fish meal has declined. It once represented one-eighth of the total fertilizer tonnage, but now comprises less than 1%. Use of tankage, bone meal and seed meals has similarly diminished. The proportional use of sodium nitrate has fluctuated greatly, dropping from about 7% in 1925, to 2% ten years later, then rising to nearly 7% in 1940 and declining again almost to the vanishing point in 1950. Use of potash salts, on the other hand, has been rather constant, but they constitute less than 1% of the total tonnage.

Chart 2 indicates the tonnage of plant food equivalents have increased more rapidly than the total tonnage, reflecting the use of higher analysis materials. Nitrogen consumption has increased more rapidly than the use of phosphoric acid. Use of potash has not increased greatly during the 25-year period.

The average composition of the mixed fertilizers, estimated from the average analyses of the official

by
Robert Z. Rollins *

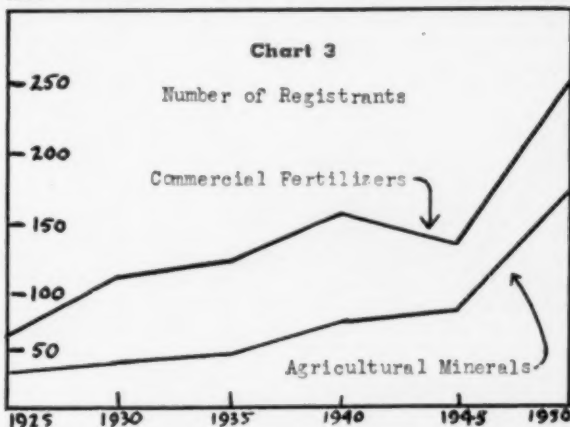
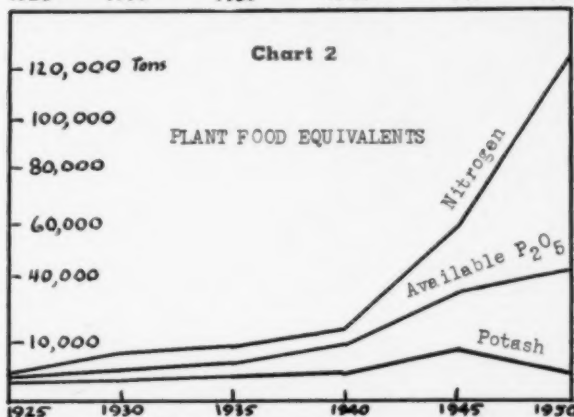
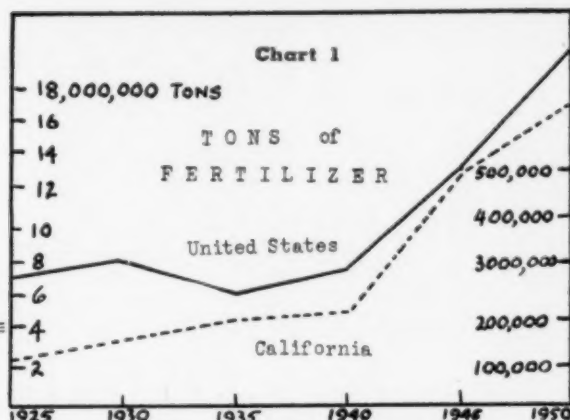
samples analyzed each year, shows that the total plant food equivalent of mixed fertilizers has increased from 17.7% to 25.3% during the 25-year period. The nitrogen content has increased almost 6%. It was originally the lowest of the three plant foods but is now the highest. The available phosphoric acid has increased about 2%. The potash content has not changed.

The tonnage of agricultural minerals has increased tenfold in the 25-year period, and most of the increase has occurred within the past ten years. Gypsum is the major agricultural mineral used in California.

Chart 3 shows the great increase in the number of registrants of commercial fertilizers and agricultural minerals. In the former category, the number has trebled in the quarter-century period, with the sharpest increase in the past five years when the number of fertilizer registrants jumped from around 70 to 250.

A similar pattern is seen in the increasing registrants in minerals, except that the rate of increase is a little steeper. From about 50 in 1925 to nearly 200 in 1950 is the record, with the greatest ascent in the period from 1945 to 1950.★★

* From paper presented at the California Fertilizer Association Convention, Fresno, Calif., Nov. 1-3, 1951.





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THE 5th Annual Cotton Insect Control Conference, sponsored by the National Cotton Council of America in cooperation with interested agencies and organizations, emphasized once again what past conferences have brought out—that cotton insect control is a continuing problem demanding continuing alertness and swift and effective action on the part of farmers to save their crop from attacks by destructive pests.

The meeting, held at the Peabody Hotel in Memphis, Tennessee, was attended by approximately 700 persons, including representatives of industry. Present also were research workers and field control personnel.

In general, boll weevil damage to cotton was less in 1951 than it had been for the past two years. However, other pests such as boll worm, pink boll worm, aphids, thrips, cutworms and spider mites caused serious losses in some areas. The exact extent of insect damage in terms of loss of cotton has not yet been made available.

A conference report and the 1952 State recommendations were made by the entomologists. (The most important changes or additions to last year's report are summarized elsewhere in this issue.) Dr. H. H. Shepherd, Production & Marketing Administration, highlighted the supply picture and pointed out that the production of organic insecticides for control of cotton pests should be adequate in 1952 providing farmers place their orders early. Emphasis was made that storage space at the manufacturing and formulating plants is limited and that to maintain adequate and uninterrupted flow of materials as they are needed, farmers should take in at least "insurance" supplies of materials likely to be consumed. However, inventories of cotton insecticides at the end of 1951 season generally were higher than those of previous years, not withstanding heavier use during the 1951 season.

Dr. Shepherd also emphasized the sulfur shortage and the necessity of using alternate materials.

700 Crowd Memphis to Attend Fifth Annual

Cotton Insect Conference

He also referred to the fact that while containers and emulsifiable concentrates would be available, they might not be in the quantity and in the type generally desired. M. P. Jones, of the USDA Extension Service pointed out that the Atlantic and Gulf Coastal areas, usually the hardest hit, escaped heavy insect damage in 1951, while more northern areas experienced moderate to heavy infestations of the boll weevil and other insect pests.

Early buying and storage of insecticides was also advocated by Paul Mayfield, Asst. General Manager of the Naval Stores Division of the Hercules Powder Company and vice-president of the National Agricultural Chemicals Association. He warned his audience that there will not be as wide a choice of products as might be desired, but with the use of alternates, the outlook is bright for the availability of materials required for crop protection. He estimated the 1952 requirements for chlorinated insecticides at 345 million pounds. Of this, an estimated 265 million pounds would be needed for domestic use while 80 million pounds will be required for export. He estimated that the agricultural chemicals industry produced more than a billion pounds of pesticides in 1951 and surmised that the same quantity of material should be available in 1952. He also told the conference that insecticide research during the past season approximated 8 million dollars on various projects, and said further that 20 companies spent a

total of nearly 4 million of this amount each year.

Dr. F. C. Bishopp, Asst. Chief, Bureau of Entomology and Plant Quarantine emphasized that strong reactions against insecticides are in evidence in many quarters and that unless dangerous poisons are handled wisely and carefully, users may face the threat of restrictive legislation.

S. L. Calhoun of Mississippi said that careless application wastes insecticides and gives ineffective control. He pointed out that poison should be concentrated on areas of the plant where pests are more likely to feed.

1951 Damage in Texas

THE panel discussion led by K. P. Ewing, BEPQ, emphasized that insects caused considerable damage to cotton in many sections of Texas in 1951 and that this would have been far greater if farmers had not used timely applications of insecticides. Mr. Ewing also said that pest damage was reduced through extensive farmer participation in the early season insect control program and also by the emergency fight waged by many farmers against cutworms, the garden webworm, the yellow striped army worm and the boll worm. Through the cooperative cotton insect survey, an accurate spot check of insect conditions were made in 44 counties representing 3,555,000 acres of cotton in central, north central, northeast and east Texas.

(Turn to page 87)

RECOMMENDATIONS

Below is important information taken from the preliminary and unedited excerpts of the Conference Report on Cotton Insect Research and Control distributed by the National Cotton Council of America, in connection with its recent meeting at Memphis, Tenn. These excerpts represent some of the significant changes or additions to the conference report of December, 1950.—Ed.

Dusts

PROGRESS has been made in the formulation of good quality dusts for use on cotton. However, some erratic results were attributed to inferior dusting qualities of the mixtures, demonstrating the essentiality of mixtures with excellent dusting properties.

Sulfur as a diluent gives dust mixtures certain undesirable physical properties. The supply of sulfur was short in 1951 and will be more so in 1952. To avoid waste, sulfur should not be used as a diluent for other insecticides. However, where spider mites are a problem, at least 40% of a good grade of dusting sulfur or some other suitable miticide is desirable in the mixture.

Sprays

RESULTS during the last three years have shown that concentrated sprays of organic insecticides applied with ground equipment and airplanes gave control of cotton insects equal to that obtained with dusts. Sprays have a wide range of usage in that they can be applied during most of the daylight hours, even under conditions of relatively strong winds (15 miles per hour). Boll weevil control has been obtained with as little as 1 gallon or as much as 15 gallons of spray per acre with the toxicant remaining constant at the recommended rate. Sprays have been successfully applied to cotton for control of all major cotton pests. Most of the new organic insecticides can be made into emulsifiable concentrates, which with the addition of water give emulsions suitable for application. Slight foliage burning has been noted in some instances when the emulsifiable concentrate was poorly formulated, or when the emulsion was improperly applied, or poorly distributed.

Most oil solutions of insecticides which have been tested caused foliage injury. Tests of experimental oils indicate that the viscosity and volatility of the oil and its aromatic content are the main factors involved in the undesirable foliage reaction.

Solvents with a relatively low boiling range and aromatic content which will

dissolve the toxicant appear to be the most desirable for use in emulsifiable concentrates. Emulsifiers and solvents should be tested for toxicity to the cotton plant and their general suitability determined before they are used in formulations.

In general, the mass medium diameter of the spray droplets should range from 100 to 300 microns. Manufacturers' recommendations should be followed in regard to pressure for specific nozzle size to insure a proper spray pattern.

For treatment of seedling cotton in most areas it is suggested that with ground equipment one nozzle per row be used to apply the spray and, as the cotton increases in size, the number of nozzles per row be increased up to three to obtain full coverage. If nozzles are kept at least 10 inches from the plant, better coverage will be obtained and danger of leaf burn will be minimized.

For use in ground equipment, it is essential that spray concentrates be diluted immediately prior to use with not to exceed an equal volume of water, and the diluted emulsion then added to the required volume of water. During the spray operation some type of agitation is essential in order to insure a uniform emulsion.

As a safety measure, it is recommended that the spray boom on ground equipment be located behind the operator.

For airplane spray application, it is suggested that from 1 to 2 gallons of spray containing the recommended amount of toxicant be applied per acre. It is essential to use some method of flagging or making of swaths for best results in airplane spraying.

For stability in storage and to prevent breakdown of the formulation when metal containers are used, the containers should be lined with some material that will not react with or cause deterioration of the concentrate. It is undesirable to reuse metal containers for the packaging of emulsion concentrates. Used containers, especially 30- and 50-gallon drums, often have breaks in the lining which are hard or impossible to detect but which will cause a breakdown of the formulation by permitting it to come in contact with the metal. Containers on farms sometime become contaminated with 2,4-D or 2,4,5-T. Such contamination cannot always be detected and reuse of contaminated containers should prove to be very hazardous to the processor as well as to the farmer.

It is desirable that the insecticides be prepared in such a way that they may be combined with each other to form a satisfactory emulsion. It is suggested that whenever possible the manufacturer prepare formulations in even multiples of the amounts of insecticide recommended per acre. The pounds per gallon of each in-

secticide in the concentrate should be shown on the label.

New Insecticides

Dieldrin was used experimentally for cotton insect control in many locations throughout the Cotton Belt in 1950 and 1951, and was recommended for cotton insect control in several states in 1951. It is effective against the boll weevil when applied at the rate of 0.15 to 0.5 pound per acre. It is effective against thrips, the cotton fleahopper, the tarnished plant bug, the rapid plant bug, the fall armyworm, grasshoppers, and the variegated cutworm when applied at dosages of 0.5 to 0.15 pound per acre. It is effective against the garden webworms at 0.25 pound per acre and against heavy infestations of pale sided and granulate cutworms and the yellow-striped armyworm at 0.375 to 0.5 pound per acre. It is not effective at low dosages for bollworm control, and DDT should be added when control of this insect is necessary. Dieldrin may increase spider mites and the mixture of dieldrin and DDT may increase aphids. Dieldrin will kill newly hatched cotton leafworms at dosages effective against the boll weevil. It is effective either as a dust or spray.

Heptachlor was used experimentally for cotton insect control in many locations throughout the Cotton Belt in 1951. It was effective in controlling the boll weevil when applied at the rate of 0.25 to 0.75 pound of technical material per acre in either dust or spray form. It did not control the bollworm and therefore should be mixed with DDT at the recommended rates when it is used for mid-season or late-season boll weevil control. Field tests indicate that heptachlor is effective against thrips at 0.25 pound per acre, against cutworms at 1 pound per acre and against garden webworms at 0.5 pound per acre.

Heptachlor did not control the bollworm, the yellow-striped armyworm, the cotton leafworm, the cotton aphid or spider mite. Heptachlor may increase spider mites and the mixture of heptachlor and DDT may increase aphids.

Parathion will control the cotton aphid, spider mites, the garden webworm, and the cotton leafworm. It may be used as a 1-percent dust alone or in combination with other insecticides. It gives very little control of the boll weevil, the fall armyworm, the variegated cutworm, the bollworm, and the pink bollworm. Bollworm populations sometimes increase following applications of parathion.

Parathion is an extremely dangerous poison. It is recommended for restricted use in some states where qualified personnel are in a position to assume full responsibility and to enforce proper precautions as prescribed by the manufacturers.

New 1951 Insecticides

Systox. Two years' field and greenhouse tests have shown this material to be effective against the cotton aphid and spider mites both as a spray applied to the foliage and as a systemic applied to the soil. The use of 0.5 milligram of technical material per pound of soil has given a month's protection to cotton against these pests in the greenhouse. In the field, 0.2 pound of technical material per acre applied to the soil gave a month's protection against aphids.

Cotton leafworms, half-grown and larger were controlled by spraying the foliage with 0.5 to 0.75 pound of "Systox" per acre. Field tests, conducted in 1951, indicate that Systox may increase the effectiveness of toxaphene against the bollworm when used at the rate of 0.15 pound or more of Systox to 2 pounds or more of toxaphene per acre.

Systox will not control the boll weevil, bollworm, thrips, or grasshoppers nor has it shown itself effective as a systemic by means of seed treatment at rates of up to 1 pound of technical material per 100 pounds of cotton seed.

Systox is an extremely dangerous poison to man and other animals. In handling it the same precautions as indicated for parathion should be followed. Until investigations disclose that this material does not persist, cottonseed meal or other cottonseed products from treated plants should not be fed to livestock.

Compound 269 is a stereoisomer of dieldrin and chemically designated as 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-tetraendo-dimetha-nonaphthalene. In limited field tests when applied as dust or sprays at 0.2 to 0.5 pound per acre, it was effective against the boll weevil, the bollworm, the tobacco budworm, the variegated cutworm, the fall armyworm, and the tarnished plant bug. It was found to be toxic to a wide range of lepidopterous larvae and at 0.2 pound per acre gave bollworm control equal to 0.5 pound of DDT. In late-season tests it gave excellent control of the boll weevil and bollworms. Compound 269 did not control spider mites and was only moderately effective against the yellow-striped armyworm. Aphids did not build up to damaging numbers following its use. Because of limited tests compound 269 is not recommended for general cotton insect control but should be widely tested in large-scale experiments in 1952. Mammalian toxicity data available indicate this compound to be highly toxic. It should be handled with extreme care.

EPN (ethyl p-nitrophenyl thionobenzenephosphonate) Laboratory tests in 1950 indicated that EPN might be useful in control of several cotton insects and mites. In field tests during 1951 EPN at the rate of 0.3 pound of technical failed to give satisfactory control of boll weevil, bollworms, cutworms and some species of spider mites. At that rate it was highly effective for control of the yellow-striped armyworm.

EPN at the rate of 1 pound of technical per acre showed promise for pink bollworm control. Control of bollworms was obtained with applications of 1.25 pounds of technical.

Further tests are needed to determine its place in the control of cotton pests.

The mammalian toxicity is less than parathion but is nevertheless high in relation to most poisons used in cotton insect control and it should be handled with caution.

Cotton Insects

AGAINST boll weevil, the following dusts have been approved for use in areas where recommended:

1. Benzene hexachloride to give 3 percent of the gamma isomer in the finished dust plus 5 percent of DDT (sometimes referred to as "3-5-0").
2. Calcium arsenate applied alternately with calcium arsenate plus 2 percent of nicotine.
3. Calcium arsenate applied alternately with a mixture of benzene hexachloride (3 percent gamma isomer) and 5 percent of DDT.
4. Lime-free calcium arsenate plus 1 percent of parathion.
5. Lime-free calcium arsenate plus 1 percent of parathion and 5 percent of DDT.
6. Toxaphene 20 percent.
7. Aldrin 2.5 percent.
8. Aldrin 2.5 percent plus 5 percent of DDT.
9. Heptachlor 2.5 percent.
10. Heptachlor 2.5 percent plus 5 percent of DDT.
11. Dieldrin 1.5 or 2.5 percent.
12. Dieldrin 1.5 or 2.5 percent plus 5 percent of DDT.
13. Chlordane 10 percent plus 5 percent of DDT. (This mixture is recommended only in areas where it has given good control. It has given erratic results in some areas, perhaps because of high temperatures and humidity.)

The following treatments with sprays made from emulsion concentrates have given favorable results and are approved where recommended.

1. Toxaphene at the rate of 2 to 3 pounds of the technical material per acre.
2. Toxaphene and DDT in the ratio of 2 to 1 applied at the rate of 2 to 3 pounds of technical toxaphene per acre.
3. A mixture to give 0.3 to 0.5 pound of the gamma isomer of benzene hexachloride and 0.5 pound or more of technical DDT per acre.
4. Aldrin at the rate of 0.25 to 0.75 pound of the technical material per acre.
5. A mixture to give 0.25 to 0.75 pound of technical aldrin and 0.5 pound or more of technical DDT per acre.
6. Heptachlor at the rate of 0.25 to 0.75 pound per acre.

7. Heptachlor at the rate of 0.25 to 0.75 pound per acre plus 0.5 pound or more of the technical DDT per acre.

8. Dieldrin at the rate of 0.15 to 0.5 pound of technical material per acre.

9. A mixture to give 0.15 to 0.5 pound of technical dieldrin and 0.5 pound or more of technical DDT per acre.

10. In areas where it has proved satisfactory and where it is recommended, a mixture of 1 pound of technical chlordane and 0.5 pound or more of technical DDT per acre may be used.

Bollworm. Effective bollworm control depends on the use of properly formulated insecticides and timeliness and thoroughness of application. DDT is the most effective insecticide known for the control of bollworms. For heavy bollworm infestations it should be applied at the rate of 1.0 to 1.5 pounds of the technical material per acre in the form of a 10 percent dust or as a concentrated spray. DDT may be used in mixtures with other insecticides where other insects as well as bollworms require control. It is compatible with lime-free calcium arsenate but not with regular calcium arsenate. Where 0.5 pound or more of DDT per acre is applied with BHC, aldrin, dieldrin, or heptachlor in the regular schedule for boll weevil control, bollworms are usually controlled.

Toxaphene, at the rate of 2 to 4 pounds per acre, is the next most effective insecticide against bollworm. This may be applied as a 20 percent dust or as a spray. The addition of DDT to toxaphene dust or spray has greatly improved the effectiveness of this insecticide for bollworm control.

Calcium arsenate and cryolite dusts are less effective.

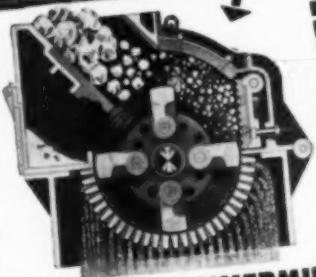
In areas where spider mites are a problem, dust mixtures containing organic insecticides used for control of bollworms should include 40 percent of sulfur or an appropriate amount of some other suitable miticide.

Cutworm outbreaks may develop in weeds or crops, especially legumes. Cutworms migrate to adjacent cotton or attack cotton planted on land previously in weeds or legumes.

Recommended control measures are thorough seed-bed preparation, elimination of weed host plants, and use of insecticides. If the need for insecticides to save the stand is to be avoided, allow at least three weeks to elapse between the time of plowing under an infested area and the subsequent seeding of the cotton crop. Toxaphene and toxaphene-DDT sprays applied at a rate of 2 to 3 pounds per acre, DDT spray at 1 to 1.5 pounds per acre and dieldrin at 0.375 to 0.5 pounds per acre are effective. Twenty percent toxaphene or 10 percent DDT dusts applied at rates of 10 or 15 pounds per acre will give satisfactory control. Poison baits containing paris green, sodium fluosilicate

(Continued on page 95)

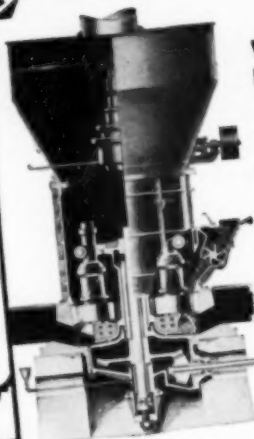
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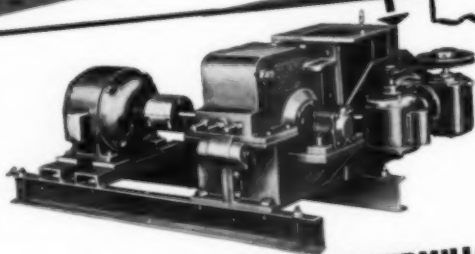
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Canadian Conferees discuss developments in

Herbicides

By

H. E. Wood

Winnipeg, Manitoba, Canada



Above: F. L. Timmons, Logan, Utah, banquet guest speaker and N. F. Putnam, Victoria, B. C., chairman of weed conference.

THE fifth Western Canadian Weed Control Conference, held in late November in Vancouver, B. C., attracted an attendance of 150, including some 25 from the United States. The 1951 meeting, while not overlooking grain crops, centered around the weed problem as it affects horticultural and forage seed crops, range and pasture land. The eradication by chemicals of woody growth, particularly from highways and utility rights-of-way, came in for discussion and recommendations.

During the past year, over eleven million acres of cereal crops in the Prairies were successfully treated with 2,4-D, to control susceptible weeds. Results of data presented on the use of herbicides experimentally, with one important exception, confirmed standard recommendations now generally followed. The several stations working with oats found this crop, unlike wheat and barley, quite susceptible to 2,4-D when from 6 to 12 inches in height; treatment is recommended before or following this danger period. Considerable testing has indicated that clovers, other than sweet, as well as alfalfa, when badly infested with weeds and if protected by a companion crop, may be treated with comparative safety with an amine

type 2,4-D at rates not over 4 ounces of acid per acre.

While horticultural crops in the main have been more susceptible to chemicals when applied to control weeds, a number of speakers outlined programs made and methods of application. These included light oils for carrots and parsnips, the dinitros for peas, corn and strawberries and potassium cyanate for onions.

Of chemicals used for brush and tree eradication, 2,4-D, with the addition of 2,4,5-T for species resistant to the former, have been most widely used in Manitoba where some 35,000 acres of highways, drainage ditches, power and telephone lines have been treated over the past three years. Dormant and basal spraying, where oil is substituted by water, is not only lengthening the season of application, but is proving equally as satisfactory as foliage treatment, or perhaps even more so. In reporting these findings, Lloyd Playfair stressed the problem of finding and adapting equipment to work satisfactorily under the widely varying conditions met with in brush control. Chemical treatment is proving cheaper, quicker and more effective than former mechanical or hand means of brush removal.

Little headway has been made to-date in Western Canada in the control of weeds on range and pasture land. The problem varies greatly from area to area and includes both a variety of weeds and woody growth. Some concern was expressed by speakers as to how best to regrow such land where the unpalatable or undesirable native growth has been removed. Evidence was presented the conference that sages and other objectionable growth could be removed by the esters of 2,4-D and 2,4,5-T.

C. E. Otis, Dow Chemical Co., San Francisco, brought to the conference the latest in "New Chemicals and New Control Methods." The trend is toward specific chemicals for specific weed problems of which "CMU," the new urea compound, seems likely to offer promise. As a soil sterilant when used on quack grass, complete kills had been reported in both Canada and the U. S. A. "MCP" which the British have favored over 2,4-D, appears to offer more selectivity to sensitive crops. Mr. Otis stated that the dinitros and "TCA" were rapidly finding their places in the program for weed destruction. "SES" he found inactive as a foliage spray, but ac-

(Turn to page 111)

**Emulsifiers
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State Fertilizer Controls

by
John D. Conner
Washington, D. C.

Part III

Part 3 is the concluding installment of this article by Mr. Conner. Reprints of the entire summary are available from Agricultural Chemicals, 175 Fifth Ave., New York 10, N. Y.—Ed.

Wisconsin⁵⁷

Scope: The law applies to mixed fertilizer and fertilizer materials. Fertilizer material is defined to include any substance containing nitrogen, phosphoric acid, potash, or any recognized plant food element or compound which is used primarily for its plant food content or for compounding mixed fertilizer except unmanipulated animal and vegetable manures and sludge sold at sewage plants at retail. Mixed fertilizers are defined to include any combination or mixture of fertilizer materials designed for use or claimed to have value in promoting plant growth, with or without inert materials.

Registration Fees: The annual registration fee is \$25.00 per grade, payable on June 30.

Tonnage Reports and Fees: In addition an inspection fee is imposed at the rate of 1¢ per ton. The fee is based on semi-annual tonnage reports covering the periods ending June 30 and December 31.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the chemical analysis. The analysis must show the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash.

Unacidulated mineral phosphate materials and basic slag must be guaranteed as to both total and available phosphoric acid and the percentage passing through a standard 200 mesh screen. In the case of bone, tankage and other natural organic phosphate materials, only the total phosphoric acid need be guaranteed.

In the case of mixed fertilizer to be labeled or otherwise represented as suitable for use as tobacco fertilizer, a guarantee must be given that the chlorine content does not exceed 2%.

The guarantee of other fertilizer elements must be separately stated as "secondary" or "minor." As to minor fertilizer elements the equivalent of the pounds per ton of the compound from which derived must also be stated. When boron is guaranteed, the percentage of soluble boron, elemental basis, and its equivalent in pounds of borax per ton must be stated. If soluble boron is present in amounts of five pounds of such borax equivalent per ton or more, the presence must be so declared.

In addition, the Department of Agriculture may require any reasonably necessary warning statement to appear on the bag, tag or container if, in the opinion of the Department, such cautions and instructions are deemed necessary for consumer protection.

Western States

Arizona⁵⁸

Scope: Commercial fertilizers are defined to include any substance, including any combination or mixture of substances, designed and fit for use in inducing increased crop yields or plant growth when applied to the soil. Expressly excluded are unmanipulated animal and vegetable manure, liming materials, gypsum, and residue or sludge from sewage disposal plants.

Registration Fees: The annual registration fee is \$5.00 per brand, expiring on December 31.

Tonnage Reports and Fees: In addition to the registration fee, an inspection fee is imposed at the rate of 20¢ per ton. Payment of the fee must be evidenced by either affixing a fee tag bearing a fee stamp to each package of fertilizer or by otherwise associating such tags or stamps with each lot.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the guaranteed analysis. The analysis must show the minimum percentages of total nitrogen, available phosphoric acid, and available potash.

In the case of bone, tankage, natural mineral phosphates or other unacidulated

phosphatic materials in which the phosphoric acid is not shown by laboratory methods to be available but may eventually become available in the soil, the phosphoric acid may be guaranteed as total phosphoric acid.

California⁵⁹

Scope: The law applies to any substance or mixture of substances intended to be used for promoting or stimulating the growth of plants, increasing the productivity of plants, improving the quality of crops or producing any chemical or physical change in the soil. Materials not containing at least 5% of plant food are classified as "agricultural minerals."

Registration Fees: The regular registration fee is \$50.00 per brand, expiring annually on June 30. An annual license fee of \$2.00 is required for salesmen, solicitors and agents, expiring annually on December 31.

In the case of commercial fertilizers, the selling price of which is less than \$8.00 per ton, no registration or registration fees are required.

Tonnage Reports and Fees: Under a 1951 amendment which will become effective January 1, 1952, the tonnage license tax is 15¢ per ton. The tax is based on quarterly statements rendered within one month after March 31, June 30, September 30 and December 31.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the chemical analysis. The analysis must show the percentages of every constituent of agricultural value claimed and the materials from which all of said constituents are derived. The analysis must state the percentages of nitrogen, specifying the form or forms in which it is present and the percentage of each form thereof, available phosphoric acid, and potash, soluble in distilled water. The percentage of phosphoric acid must be expressed in terms of phosphorus pentoxide and the percentage of potash in terms of potassium oxide.

(Turn to page 89)



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CONTROL of insect pests by means of electronic treatments, a scheme which entomologists and manufacturers of agricultural insecticides laughed at when they first heard of it a year or two ago, does not seem to be dying the quick death predicted for it. As a matter of fact, although field tests when supervised by competent, disinterested parties have failed to support the control results claimed by the inventors of the so-called "Ukaco Process," though most informed observers consider the whole idea preposterous, and though the U. S. Department of Agriculture has looked with a suspicious eye on the scheme, still the idea has gained ground. It has attracted the support of some rather solid citizens and recently \$25,000 in public funds is reported to have been allotted by the State of Pennsylvania to try out the method on forest insect control.

To set the general background for the electronic pest control story, tests and field applications have apparently been in progress since about 1948. The name "Ukaco," used to describe the process, is taken from the names of the three inventors, Curtis P. Upton of Sunol, California, a civil engineer, W. J. Knuth of Corpus Christi, Texas, radio and television engineer, and H. H. Armstrong of Newport, Pa., chemist and

ELECTRONIC BUG CHASER

*its effectiveness questioned . . .
inventors claim amazing results,
which disinterested observers
have been unable to duplicate.*

professional inventor. They are organized as the UKA Co., Sunol, Calif. Patents for the process have been applied for and are pending. A second company, The Homeotronic Memorial Research Foundation, has also been chartered in Pennsylvania within recent months, it being described as a non-profit organization to develop the process experimentally. President of this Foundation is Col. Henry M. Gross of Harrisburg. Still

a third company is reported being formed. It is to be called the Radiurgic Corporation. Its function will be to make the process available commercially to farmers. The developers of the "process" have made what has apparently been a valuable tie-up with the Pennsylvania Farm Bureau, and B. A. Rockwell, director of research of the bureau, has been active in test work from which he has reported very favorable results, which incidentally other disinterested agencies have not found it possible to duplicate in the field.

Two other prominent men

Below: The mysterious "Ukaco" device is seen in a recent test. (Photo by "Farm Bureau Mirror," Harrisburg, Pa.)



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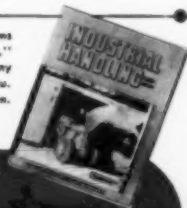
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that a tremendous amount of application experience has been accumulated so that accurate production and cost figures can be estimated for new applications. You are invited to find out how the "PAYLOADER" can boost production and cut material handling costs in your plant as they have in so many others. The Frank G. Hough Co. 743

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HELP for your material handling problems is in the pages of "Industrial Handling," the free Hough magazine. Catalogs on any size "PAYLOADER" (12 cu. ft. to 1½ cu. yd.) are also available, without obligation.



who have become identified with the project recently are R. N. Benjamin, executive secretary of the Pennsylvania Farm Bureau Cooperative Association, and Dr. William J. Hale, research consultant for Dow Chemical Co., who in recent years has been more actively identified with the Farm Chemurgic movement, which incidentally up to this point at least has proved to be more visionary than practical.

Such schemes as this homeo-electronic proposition should not be exactly a novelty in the farm belt, which, it may be remembered, was the principal outlet for lightning rods around the turn of the century. But in the old days when the con man from the big city made his tour through the rutabaga areas, he normally played one night stands, made a fast pass, a quick killing and then was on his way.

This electronic insect control deal is definitely a different sort of pitch. The people whose names are associated with it are distinctly reputable, and even though they may be deluded in their confidence in the device, most of them at least are very evidently sincere in their belief that it will do what is claimed for it. And with the many phenomenal scientific developments of recent years, particularly those in fields that are not too well understood by the layman, it is understandable that belief can be induced for some mighty strange sounding schemes. The farmer, and those associated with him, naturally want to believe that there is an easy way to control insect pests. They would like to find that they can kill bugs without the hazards of applying toxic insecticides, without the expense and the physical effort which they begrudge. Since they want to believe an easy way can be found, and since they have been conditioned to believe, particularly since the atomic experiments, that nothing is impossible to modern science, there is a fertile field today for even the most preposterous "scientific" ideas.

It is rather difficult, too, for the usual agencies which check on

such claims to bring out the true facts on stories like this electronic debugging device. Test work with insecticides or insecticidal devices necessarily takes a lot of time and money, and those who have the time and money to spend normally want to use it on some material or program that they think shows good possibilities of success, rather than employing it to demonstrate that a device or program which they believe to be faulty is actually as worthless as they feel confident it must be. They are, in other words, interested in pursuing potentially positive rather than negative projects.

But, in the present case, some agency or another may eventually have to put in the work necessary really to test this electronic device, to subject it to experiments by unprejudiced investigators which alone can indicate whether it has merit or not. First step, no doubt, should be an appraisal of the device by a competent and disinterested electronic engineer. No such tests have as yet been made, so far as we have been able to determine, and as a matter of fact the developers of the device have not encouraged tests of their method or device by competent state or federal entomologists.

Dr. L. E. Dills of Pennsylvania State College has carried on some test work. However, Dr. Dills, in response to an inquiry from *Agricultural Chemicals*, — reports as follows: "Since we did not have sufficient information on the energy given out by the apparatus and no method was available for measuring it, our data is of questionable value. We are not planning on publishing our results and the group believes that anything which we can furnish you on this subject at this time would have little value."

The U. S. Department of Agriculture has naturally had occasion to make some checks on the device, since it has been encountered in the field in many areas, particularly in California, Arizona, Texas and Pennsylvania. While the Department has taken no official position on the merits or lack thereof of the device,

it is reported unofficially that their field men who have had an opportunity to check on test work, and to talk to the inventors, feel that the claims are greatly exaggerated. Wherever they have checked they are reported to be of the opinion that the success of the "Ukaco method of control" has definitely not been substantiated. Nevertheless until a thorough investigation of the company and its claims has been made, department officials recognize they would be on weak ground in coming out definitely and forcefully in condemnation of the machine and method of its use.

How It Works

BUT perhaps we should revert, for those who are as yet unfamiliar with the device, to explain what it is and how the inventors claim it works, fictional though the story may sound. Homeotronics, they define as treatment by small applications of electronic waves. It has been demonstrated, they explain, that many living organisms or biological processes give off radiation. Their work, they say, has shown that each living plant organism gives off radiations of definite frequencies and that each individual has a specific frequency. In order to treat a given plant electronically, the key to its specific frequency is found and registered on a key plate. This plate is then attached to their device, the Ukacometer, which reproduces the frequency, amplifies it and carries it back to the plant by radio waves. If some other substance, an insecticide for example, is placed on top of the key plate, its specific frequency, they claim, is added to that of the plant, and a modulated wave can then be broadcast back to the plant, thus giving the plant this added frequency characteristic. Simple, if you understand it!

The key for an individual plant is obtained by placing one end of an ordinary lead pencil, sharpened on both ends, on the stem of the plant and an ordinary card is moved across the other point, im-

(Turn to page 87)



LION provides one-stop nitrogen service to Southern fertilizer manufacturers

Lion Anhydrous Ammonia — Manufactured in Lion's modern plant to an 82.25% nitrogen content under accurate chemical control, the uniformity and high quality of this basic product are assured.

Lion Aqua Ammonia — This product is available to manufacturers for use in the formulation of mixed fertilizers or for sale as direct application material. Normally about 30% ammonia, its content can be controlled by order to suit your needs.

Lion Nitrogen Fertilizer Solutions — Made specifically for the manufacturing of mixed fertilizers, these products supply both ammonia nitrogen and nitrate nitrogen in the ratios desired. They are easily handled and available in three types designed for varying weather conditions, and for formula requirements in the production of fertilizers that cure rapidly, store well and drill evenly.

Lion Ammonium Nitrate Fertilizer — The improved spherical white pellets in this product contain a guaranteed minimum of 33.5% nitrogen. They flow freely, resist caking and store much better. Lion Ammonium Nitrate Fertilizer is shipped in 100-pound, 6-ply bags with two moisture-proof asphalt layers.

Lion Sulphate of Ammonia — This new, superior-type sulphate is guaranteed to contain a minimum of 21% nitrogen. Through special conditioning of the larger crystals, moisture and free acid content is greatly reduced. These factors, together with the special coating applied, make for greater resistance to caking in shipment or in storage. This product flows freely. It is shipped in bulk and in 100-pound, 6-ply bags laminated with asphalt.

"Serving Southern States"

Technical advice and assistance to fertilizer manufacturers in solving their manufacturing problems is available for the asking . . . just write.

LION OIL COMPANY

Chemical Division • El Dorado, Arkansas

AGRICULTURAL CHEMICALS

Suppliers' Bulletins

Prentiss Issues Catalog

Prentiss Drug & Chemical Co., New York, has issued a 54-page catalog describing its full line of drugs, chemicals, insecticides and rodenticides. The rodenticide and insecticide division contains a complete description of the firm's warfarin compound, "Rax Powder," including instructions on the preparation of warfarin baits. Insecticides are listed with a page of descriptive matter devoted to each item. These include Prentiss' pyrethrum, rotenone, liquid and powdered DDT, toxaphene compounds; lindane compounds; chlordane and sabadilla. The final page in this section is devoted to red squill, for which a complete description is given.

Copies of the catalog are available from the company's main office, 110 William St., New York 38, N. Y.

New Emergency Shower

Emergency and decontamination showers for workers in chemical plants are described by Logan Emergency Showers, Inc., Glendale, Calif., in its bulletin No. 30. Three basic models of showers are offered to meet requirements of maximum, medium and minimum exposures. They all use spraying water to quench rapidly any fire, and to dilute and remove acids or other chemicals and foreign materials contaminating clothing or the body.

The first shower covers all parts of the body with nozzles from above, all sides and the floor, the second from most of these angles, and the third from the top only. The bulletin is available from the company at P. O. Box 111, Glendale, Calif.

Mixer Catalog Available

A new mixer for dispersing, emulsifying and milling in one operation is described in a catalog issued by Abbe' Engineering Co., New

York. For chemicals, the mixer is used on initial mixing of raw materials; on intermediates and finished products. The makers claim it saves up to 75% of the time required to dissolve chemicals in water and other solvents by ordinary mixers, and makes emulsions and dispersions in about one-fourth the time of conventional mixers. Write for catalog 68, care of the company, 50 Church Street, New York 7, N. Y.

Boyce Thompson Reprint

Boyce Thompson Institute for Plant Research, Inc., Yonkers, N. Y. has reprinted seven review papers on recent developments in the field of fungicides. The articles were summarized in the July-September, 1951 issue of "Contributions from Boyce Thompson Institute," and the reprint groups them into a single unit.

Authors preparing the articles were: R. H. Willman, "The Economics of using Fungicides;" S. R. A. McCallan, "Testing Techniques;" W. H. Tisdale and A. L. Flenner, "Derivatives of Dithiocarbamic Acid as Fungicides;" J. G. Horsfall and Saul Rich, "Fungitoxicity of Heterocyclic Nitrogen Compounds;" R. H. Gruenhagen, P. A. Wolf, and E. E. Dunn, "Phenolic Fungicides in Agriculture and Industry;" George L. McNew and Harry P. Burchfield, "Fungitoxicity and Biological Activity of Quinones;" and F. R. Whaley and J. B. Harry, "Chromate Complexes as Fungicides".

The reprint is being distributed for \$1 from the Publication Office of Boyce Thompson Institute, Yonkers 3, N. Y.

Emulsol Products Listed

Emulsol Corporation, Chicago, has issued a new list of its products for the agricultural and household pesticide fields. Included are the various "Emcol" products,

emulsifiers for DDT, toxaphene, chlordane, Heptachlor, IPC, aldrin, dieldrin, parathion, BHC, lindane, 2,4,5-T and 2,4-D. The company explains that this brochure is to illustrate the range and scope of the products rather than being a complete listing of its line. The brochure is available from the company, 59 E. Madison St., Chicago 3, Ill.

Announces Power Shovel

Lessmann Manufacturing Co., Des Moines 4, Iowa, has announced a new tractor-mounted power shovel for use in fertilizer plants, featuring a shovel which loads while the tractor is standing still, and digs 12 inches below wheel level. Other features described in a new brochure include the ability of the machine to dig in on level ground; to load the shovel at any height; to unload shovel at 42 inches from tractor; and to load shovel without ramming.

Specifications of the machine include the following statistics: 74-inch wheelbase, shovel dump time 4 seconds; return, 3 seconds. Weight, approximately 8,000 pounds. Full information is available from the manufacturers.

Spray Equipment Catalog

A new catalog describing its line of "Brodjet" sprays has been issued by Hanson Chemical & Equipment Co., Beloit, Wisconsin. Pictured are the various nozzles and other equipment the company manufactures, with gallonage charts showing the correct amount of material to use at various speeds at different pressures. Write the company for a copy of the catalog.

Lehmann Service Offered

A new 8-page booklet, "Lehmann Certified Reconditioning Service—Right to the Roots," has been issued by J. M. Lehmann Co., Inc., Lyndhurst, N.J., to describe the company's methods of reconditioning worn machinery such as mills used in chemical plants. The booklet is well illustrated in two colors. Write for your copy, care of the company, 550 New York Ave., Lyndhurst, N.J.

Announcing

DDT and Parathion in a new, dustless, easy-to-use, all-summer cover spray



Black Leaf 253 is big news for fruit growers! It simplifies summer spraying, by replacing other more complicated and more expensive cover spray programs with one highly-effective, low-cost product.

This superlative new spray material is Black Leaf Tobacco Base "impregnated" with 25% of DDT and 3% of Parathion by an exclusive process. Thus Black

NOW you can produce more clean fruit with simple, easy, one-product control of codling moth, red-banded leafroller, leafhoppers, European red mite, red spider mite, San Jose scale, Forbes scale, and similar pests.

How to Use Black Leaf 253

Start your summer spray program with Black Leaf 253 and continue to use it throughout the season, as often and as long as necessary. Each application should be thorough, especially if red-banded leafroller or similar pests are a problem.

Use 2½ pounds in 100 gallons of water and repeat at the cover spray intervals recommended by local authorities. Use 2 pounds, if the interval between sprays is shorter than usual or if infestation is unusually low. Use 3 pounds, if the interval between sprays is longer than usual, or if infestation is severe.

Make such specially-timed, supplemental applications as may be recommended in your area to control apple maggot, curculio, or red-banded leafroller.

Do not use Black Leaf 253 within 30 days of harvest. When sprays must be applied to protect early varieties just before or during harvest, use 2 to 3 pounds of Black Leaf 155 (fixed nicotine) which leaves no undesirable chemical residue.

Leaf 253 is equipped to provide "double-barrel" control. During years of research and development, Black Leaf 253 topped all other cover spray programs tested, in TOTAL CLEAN FRUIT.

Dustless. There are no billowing clouds of dangerous dust, when you handle Black Leaf 253. Scientifically treated to eliminate dust, Black Leaf 253 is easy to use. As the tank is refilling, the desired quantity can be dumped into the water where the agitators disperse it quickly and uniformly.

Compatible. Black Leaf 253 is compatible with all the fungicides and other materials generally recommended in combination with DDT and Parathion, such as wettable sulphur, ferbam, etc.

Less residue. Black Leaf 253 provides excellent control with the least possible chemical residue and essentially no visible residue when the fruit is harvested.

Black Leaf 253 has been used very successfully on all important varieties of apples. When spraying McIntosh or Golden Delicious, susceptible to Parathion injury, follow recommendations of local authorities.

For additional information on Black Leaf 253 and other members of the famous Black Leaf family of pest control products, communicate with the nearest office below. Your inquiry will receive prompt attention.

Tobacco By-Products & Chemical Corporation
Richmond, Va. • Louisville, Ky. • Montgomery, Ala. • Waco, Texas • San Francisco, Cal.

DEPENDABLE PEST CONTROL PRODUCTS SINCE 1885

AGRICULTURAL CHEMICALS

Technical Briefs

Sulfur Fungicides Tested

The results of 10 years of orchard testing of fungicides for apple scab control in New York State indicate the importance of orchard and weather conditions in relation to scab development and, therefore, to the type of fungicidal program required.

Records of maturity dates of ascospores for the period 1930 to 1944 show that ascospores were mature each year by the time any susceptible host tissue was exposed on the McIntosh variety.

The time of the first infection in relation to host development was determined by the occurrence of sufficient rain to give an infection period rather than ascospore maturity. During a period of 15 years it was observed that the first infection on McIntosh in the Hudson Valley occurred in six seasons when the host was in the green tip to delayed dormant stage, in five seasons during the pre-pink or pink stage, and was delayed until bloom or calyx in four seasons due to dry spring weather.

The most critical period for primary scab infection was found to be during the latter part of April, May, and June. The earliest date of ascospore discharge observed was April 6 and the earliest date of complete discharge was June 10.

Eight fungicide applications timed to protect the new growth during infection periods proved sufficient for the control of scab in McIntosh orchards having an abundant primary inoculum in years favorable for disease development.

"Magnetic 70" and the flotation sulfur pastes at concentrations of about 4 pounds of actual sulfur per 100 gallons were as effective, on the average, against scab as lime-sulfur over a period of 7 epidemic scab years. Stauffer's "Magnetic 70" sulfur paste was found to be the most retentive of all the wettable sulfurs

that approach the requirements for redistribution. Micronized was the only one of the dry wettable sulfurs tested which gave a consistent performance and approached the effectiveness of the paste types.

The fungicidal effectiveness of ground wettable sulfurs was found to be inversely proportional to the size of the particles. Wettable sulfurs should have an average particle size of less than 5 microns. Increasing the concentration of products containing coarse sulfur particles did not compensate for the particle size factor. To obtain disease control under environmental conditions favorable for scab development, a minimum concentration of 4 to 5 pounds of actual sulfur per 100 gallons of the best

sulfur material was required.

Oil-type stickers improved the effectiveness of wettable sulfurs under some conditions. While wettable sulfur, particularly the paste type, may give protection when applied during rain periods, the addition of "Orthex" is suggested. Hydrated spray lime increased the rate of setting of wettable sulfurs and improved their retention. The kind and amount of adjuvants added are vital factors in the initial deposit and retention of spray materials.

It was found that "Coposil" and "Fermate" could be substituted in the spray program to control certain other diseases, to avoid high temperature injury, or to avoid injury when it was necessary to use certain insecticides which are not compatible with sulfur.—Summary of New York State Bulletin 747, "Orchard Tests for Apple Scab Control in New York State," by J. M. Hamilton and D. H. Palmiter.

Effects of DDT and BHC on Soil, Plant Growth

EXTENSIVE greenhouse and field experiments on the effects of DDT, BHC and certain other insecticides upon plant growth when mixed with the soil have been in progress at the Plant Industry Station of the U.S.D.A. at Beltsville, Md., since late in the summer of 1945. The following summary gives the results obtained primarily in studies with DDT, but includes some data on BHC, chlordane, toxaphene and parathion. The period covered by this report extended through May, 1949.

Most of the work involved the growing of a large number of crops and varieties from seed sown in replicated small plots of treated soils in benches in the greenhouse and noting the effects of treatment on germination, stand, and growth of young plants. The numerous crops were grown in the greenhouse in rapid succession; most of them were harvested and the average plant weights were determined about a month to 6 weeks after planting.

Studies of effects of DDT were conducted on four soils in the greenhouse: Chester loam, Sassafras sandy loam, Evesboro loamy sand, and an acid muck from New Jersey. Other substances were studied only on Chester loam.

Treatments consisted of single applications of carefully measured amounts of the test substance thoroughly mixed with the soil of each plot. Typical treatments involved 0, 25, 100, 400, and 1,000 pounds per acre of DDT and of toxaphene; 0, 100, 200, and 400 pounds of BHC; 0, 25, 100, and 400 pounds of chlordane; and 0, 1.5, 3.0, 6.2, 12.5, 25.0, 50.0, and 100.0 pounds per acre of parathion. All materials were applied on the basis of weight per unit area of soil approximately 6 inches deep in the beds.

Two years' data are presented on a field experiment with DDT established in 1947 and chiefly involving replicated plots treated with DDT at 0, 25, 50, 100, and 200 pounds per acre.



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BILLION DOLLAR BUG

Since the Boll Weevil first came across the border, he has chewed up more than \$ billion dollars worth of cotton!

But this bug is now on the skids. Pesticides formulated with Tennessee's Benzene Hexachloride (BHC) give weevils the kiss of death—in a hurry. You can see immediate effects of BHC formulations . . . after dusting or spraying.

Saving cotton is but one of the contributions of chemicals from Tennessee . . . an industry serving all industry and agriculture.



Species and varieties differ markedly in their sensitivity to DDT in the soil. Abruzzi and Rosen rye and Stringless Black Valentine bean are among the most sensitive observed. They are consistently and significantly depressed in growth by 100 pounds or more of DDT per acre on mineral soils. Pound for pound, DDT was much less toxic on the acid muck than on the mineral soils used. Effects upon such very sensitive species were produced by as little as 25 to 50 pounds of DDT in carefully controlled experiments. Other beans, beets, most legumes, cucurbits, and tomatoes were moderately to highly sensitive. Most grains, including corn, members of the cabbage family, and Irish potatoes were moderately to highly tolerant. Two varieties of sweet corn showed no reduction in growth on soil containing 1,000 pounds per acre of DDT. It will require years to learn the relative tolerance of all the more important crop varieties.

In general, DDT had but slight effect upon germination and stand, even among species that are sensitive after emergence. At concentrations of 400 and 1,000 pounds per acre, however, stands were significantly depressed.

DDT showed no decrease by chemical analysis or decline in toxicity on mineral soils over the 4-year duration of the work reported here.

The o,p' isomer of DDT appeared about four times as toxic as the p,p' isomer in limited tests. The 20 pounds of the former that is present in 100 pounds of technical DDT depressed growth as much as the 75 pounds of the latter.

Technical BHC is generally harmful to germination and stand of all crops tested at 400 pounds per acre. Only the more sensitive crops were harmed at 100 and 200 pounds. It appeared more toxic to later growth than DDT, pound for pound, and no highly tolerant crops were noted, as were observed with DDT. Two hundred pounds per acre of technical BHC was highly toxic to subsequent growth of all crops tested, although it was more

toxic to some than others. One hundred pounds was harmful to a majority of crops tested.

Highly purified gamma isomer of BHC, more than 99 per cent pure, applied at the same rates as the technical grade, had no effect on germination and stand. It did, however, appear to depress growth of most crops tested as seriously as did the technical grade, pound for pound. In practice only about one-eighth as much pure gamma isomer needs to be used as if technical BHC is applied for insect control.

Less extensive tests indicated that chlordane was even more harmful to germination and stand than BHC soon after putting it into the soil in amounts of 100 pounds per acre or more. Most vegetable crops tested were significantly depressed in stand by as little as 25 pounds per acre. Corn appeared tolerant. Honey Dew melon appeared especially sensitive. In subsequent growth, 100 pounds per acre or less appeared to be without consistent effect, but 400 pounds reduced growth of most cucurbits, tomato, and beet markedly. Beans, members of the cabbage family, sweet corn and cotton appeared somewhat tolerant.

Limited tests on toxaphene, all within 4 months of its mixing into the soil, indicated that amounts of 100 pounds or more per acre depressed somewhat the germination of all vegetable crops tested except sweet corn. Only tomato and watermelon were affected significantly. In subsequent growth cucurbits and tomato were significantly depressed in growth while corn and beans were not at 400 pounds per acre of toxaphene.

Also in rather limited tests, relatively heavy doses of parathion appeared to have a slight but temporary depressing effect on germination and stand. In a few tests run soon after application, tomato, muskmelon, and snap bean were depressed in growth by 50 or 100 pounds per acre. Crops planted some months after soil treatment were quite unharmed.

Extensive data on persistence

of these substances in the soil are presented only for DDT. DDT was found to be very highly persistent in its toxic effects on plants, no measurable decrease in toxicity occurring after 4 years. BHC is less persistent than DDT, but it is believed to be persistent enough to accumulate temporarily to a harmful degree in the soil under some conditions of practical use. After 3 years about half of a 100-pound application had disappeared.

Chlordane is said to be less persistent than DDT. Its persistence as an insecticide suggests, however, that it is persistent enough to accumulate to some extent in the soil. Toxaphene has been shown to be susceptible to breakdown by soil organisms, and is believed to be relatively unstable in the soil, therefore, it is less likely than some other insecticides to accumulate harmful residues. Parathion is evidently unstable and is used in such small amounts per acre that it is not now an object of concern as a potential harmful residue in the soil.

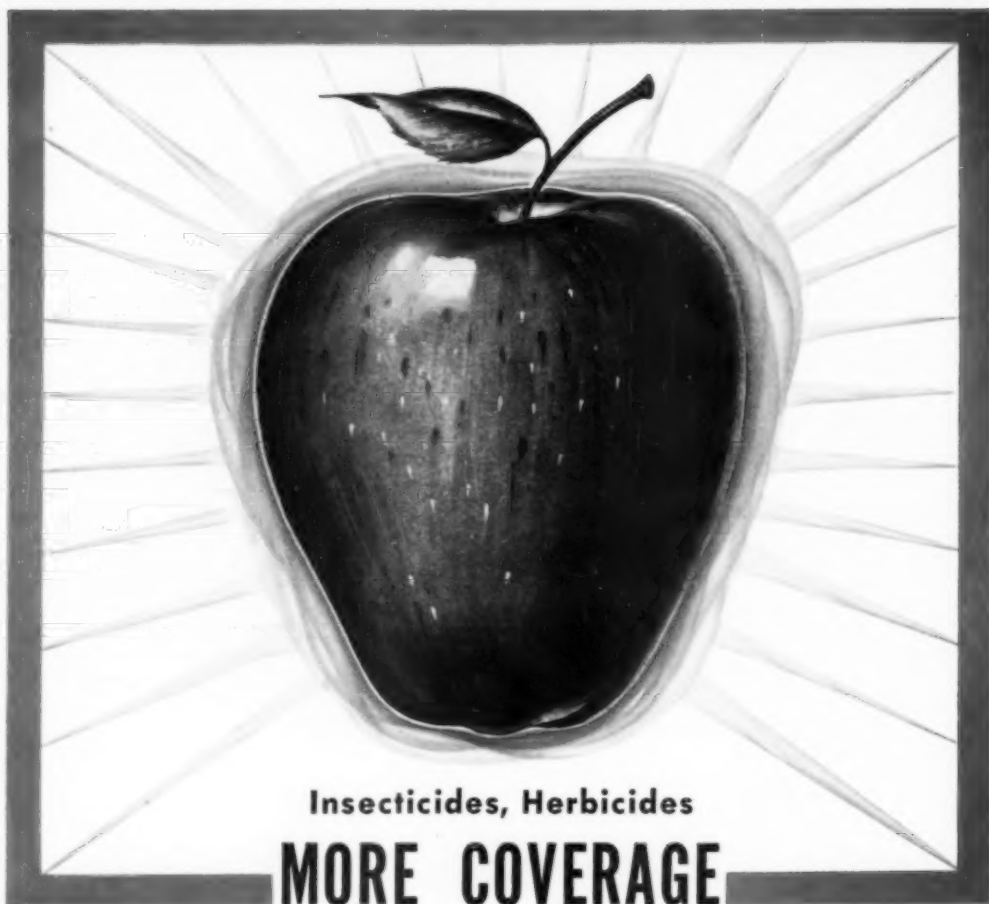
—USDA Circular No. 562: "Some Plant Responses to Certain Insecticides in the Soil", by Arthur C. Foster, senior pathologist, Div. Fruit & Veg. Crops & Diseases, ARA.

Stored Corn Protection

In tests to determine the efficacy of DDT in protecting stored corn for grain insects, heavy, closely-woven cotton bags were dipped into or sprayed with 2.5% 5% and 10% DDT in solution with carbon tetrachloride.

Bags impregnated by the 2.5% solution gave very little protection. Bags treated with the 5% solution offered much greater resistance to penetration and gave fair protection to enclosed corn for 12 months. Very good protection was given for 18 months to corn in bags impregnated by a 10% DDT solution. There was little difference in the efficiency of dipping or spraying for impregnating the bags.

Grain stored in impregnated bags was first fumigated to kill all stages of insects which might have been present in the grain.—Bull. 571, Ky. Agricultural Exp. Station.



Insecticides, Herbicides
MORE COVERAGE

greater wetting power

Formulators of insecticides and herbicides produce better products—and, therefore, better sales—when they include an active emulsifier in their formulations.

Monsanto emulsifiers perform two important functions: (1) They make it possible to secure a uniform emulsion, by transforming an organic solvent or oil concentrate into an "emulsifiable concentrate." This can be diluted with as much as 10 to 50 parts or more of water... (2) By adding wetting and dispersing properties, they

assure greater over-all covering power and, therefore, greater effectiveness.

For full information on emulsifiers and dispersants for insecticides, herbicides and fungicides, write MONSANTO CHEMICAL COMPANY, Organic Division, 1700 South Second Street, St. Louis 4, Missouri.

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EMULSIFIERS



DISPERSANTS

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The Listening Post

Fungicide Tests are Reported

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of **AGRICULTURAL CHEMICALS**. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller



ARTHUR Holloman, Jr., and Roy A. Young, of the Oregon Agricultural Experiment Station, tested fungicides for the control of the leaf spot disease of gladiolus caused by the fungus, *Botrytis gladiolorum* which may also cause flower spot and corm rot, and is the limiting factor in commercial production in several sections of the United States where the gladiolus is grown primarily for sale of cut flowers. The leaf and flower spot phases of the disease are not usually a factor in commercial gladiolus production in Oregon, except in fields where overhead irrigation is used or where air movement is restricted. Normally the humidity is too low for widespread development of the disease until fall rains start in September, well after the blooming period. The foliage may be destroyed, although such destruction usually occurs too late in the season to be an important factor in the sizing of corms. However, the accompanying build-up of the pathogen may result in large losses from *Botrytis* corm rot in the ground and later in storage.

Fungicide evaluation trials were conducted in 1949 and 1950 to select those materials most effective in control of *Botrytis* leaf spot of gladiolus under Oregon conditions. The effectiveness of 16 chemicals in inhibiting germination of spores of the fungus was measured. Spore germination trials were conducted on plates of 2% agar and 1% dextrose to which chemicals had been added to give the desired concentrations. Five of the most promising fungi-

cides were selected for field evaluation.

In 1949, a plot was established cooperatively with a grower approximately 10 miles southwest of Portland and in 1950 a similar plot was laid out on the Horticulture farm at Corvallis. In both plots overhead sprinkler irrigation was used. The variety Pandora was used in 1949 and Snow Princess was used in 1950.

In each case a five by five Latin square field plot design was used. Each replication consisted of 30 feet of row in 1949 and 20 feet of row in 1950. Corms were planted at the rate of six per foot of row. Sprays were applied weekly starting approximately August 1, before *Botrytis* leaf spot had appeared. A three-gallon Hudson sprayer operated at a pressure of about 50 pounds was used for all spraying.

In October, 25 plants were selected at random from each replication and cut at ground level. The samples were taken to the laboratory and approximately 100 leaves were counted at random from each sample. Five grades of diseases were set up as follows:

- 0 - No *Botrytis* lesions
- 1 - 0 to 5 percent of leaf area necrotic
- 2 - 5 to 25 percent of leaf area necrotic
- 3 - 25 to 50 percent of leaf area necrotic
- 4 - 50 to 100 percent of leaf area necrotic

Table 1

Control of *Botrytis* leaf spot of gladiolus by different fungicides in 1949 as indicated by a computed disease index.

Fungicide and quantity used in 100 gallons of water	Disease index in replication					Average disease index
	I	II	III	IV	V	
Ferbam 2 lbs.	11.75	12.50	17.50	13.61	13.97	13.86*
Nabam 2 qts.	12.00	20.00	26.25	19.75	16.08	18.61*
Phygon XL 1 lb.	18.68	37.09	25.25	19.75	16.08	18.61*
Puritized						
Agr. Spray 1 qt.	36.36	34.50	31.93	27.50	39.00	33.85*
Untreated check	55.00	37.75	43.80	46.68	40.09	44.62

All spray mixtures contained Rohm and Haas Triton B1956 1/2 pt./100 gal.

* Least significant difference at the 1 percent level 9.52

Table 2

Control of *Botrytis* leaf spot of gladiolus by different fungicides in 1950 as indicated by a computed disease index.

Fungicide and quantity used in 100 gallons of water	Disease index in replication					Average disease index
	I	II	III	IV	V	
Ferbam 2 lbs.	25.00	24.25	22.33	21.25	21.00	22.76*
Nabam 2 qts. + 1 lb.						
ZnSO ₄	34.49	38.12	38.75	40.75	35.25	37.47*
Phygon XL 1 lb.	54.24	54.00	54.33	59.34	55.19	55.42*
341C 1 qt. +						
1/2 lb. lime	52.83	55.05	55.44	60.89	47.75	54.39*
Untreated check	60.00	63.13	60.25	70.75	56.25	62.07

All spray mixtures contained Rohm and Haas Triton B1956 1/2 pt./100 gal.

* Least significant difference at the 1 percent level 4.32



A WHOLE FARM THRIVES ON NOURISHMENT

Pigs . . . cattle . . . wheat . . . a farm is growing 24 hours a day.

This means an enormous drain on the rich plant-food elements within a farmer's soil. For these soil ingredients provide the basic starting point for the nourishment of plants, animals . . . even man.

Many of the most effective soil-replenishing fertilizers contain POTASH . . . often Sunshine State Potash, a product of New Mexico. Such fertilizer is more than a mere soil nutrient. It strengthens the crops . . . effectively helping them to resist disease and drought.



Reg. U. S. Pat. Off.

HIGH GRADE MURIATE OF POTASH 42/43% K_2O
GRANULAR MURIATE OF POTASH 48/52% K_2O
MANURE SALTS 20% K_2O MIN.

UNITED STATES POTASH COMPANY, Incorporated, 30 Rockefeller Plaza, New York 20, N. Y.

Each sample was graded into the above classes and a disease index was derived and placed on the basis of 100 percent by application of the formula:

$$\frac{X(0) + X(1) + X(2) + g(3) + X(4)}{4t}$$

where X = number of leaves in each class

t = total number of leaves counted

4 = number of highest disease class.

The accuracy of such a formula in evaluating levels of plant diseases has been well established.

The materials used in the trials, concentration, and degree of disease control as indicated by a computed disease index are shown in Tables 1 and 2.

In both the 1949 and 1950 trials, weekly application of ferbam at the rate of 2 pounds per 100 gallons of water gave excellent control of *Botrytis* leaf spot of gladiolus. Statistical analysis of the 1949 data showed that ferbam and nabam were significantly better than "Phygon" and "Puritized Agricultural Spray" and that application of the latter two materials resulted in significant reduction of disease as compared to the untreated checks. In 1950 the incidence of leaf spot in the ferbam sprayed plots was significantly less than in any of the other treatments. Nabam was superior to "Phygon" and "Crag Fruit Fungicide 341C," and the latter two materials caused a significant reduction in leaf-spot incidence as compared to the untreated check.

In both years ferbam was far superior to the other materials tested in preventing development of leaf spot, although all of the materials gave a significant decrease in the level of disease as compared to the untreated check. Actually ferbam was relatively more effective in controlling disease than is indicated by the difference in disease indexes. This is because the method of data assessment tends to overemphasize the severity of disease. This fault could probably be avoided by the

use of additional disease classes. It is interesting to note that the relative effectiveness of the chemicals in preventing spore germination was

comparable to their relative effectiveness in preventing gladiolus leaf-spot in the field.

(Turn to page 113)

Table 3
Toxicity of methyl bromide to
Corynebacterium sepedonicum

lbs./1000 cu. ft.	Treatment Duration hrs.	Number tomato plants inoculated	Number tomato plants showing ring rot symptoms
46	2	60	60
23	16-20	60	47
46	16-20	50	50
60	16-20	20	20
No treatment		60	59

Table 4
Toxicity of methyl bromide to
Fusarium sambucinum

lbs./1000 cu. ft.	Treatment Duration hrs.	Number tooth- picks contaminated	Number toothpicks on which organism survived
46	2	19	17
23	16-20	20	18
60	16-20	20	15
No treatment		20	20

Soil Residues Under Cooperative Study

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is connected with the department of Insect Pest Survey and Information, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the United States.

By Kelvin Dorward

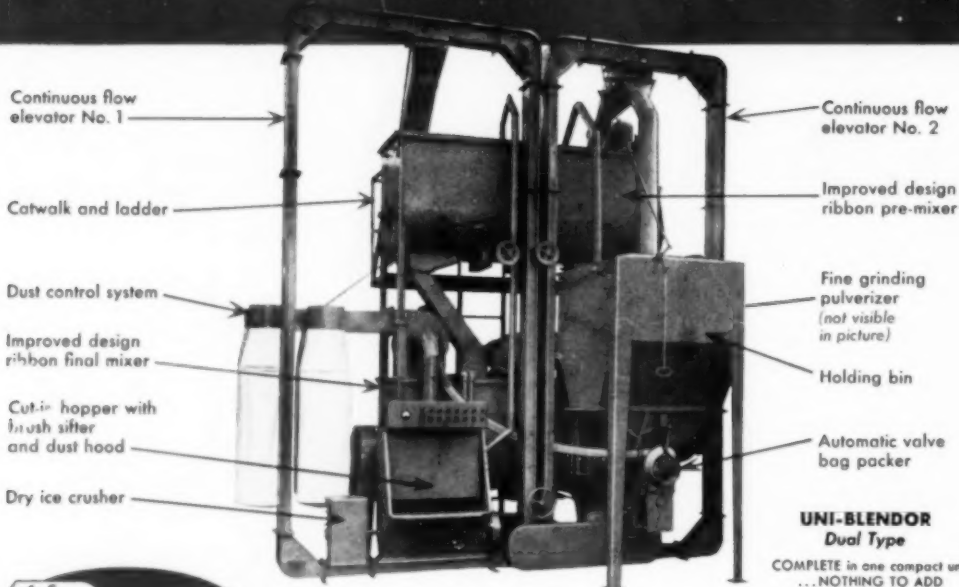


THE widespread use of insecticides on crop foliage has created the problem of determining the effects of their presence in the soil on the growth of various crops. Especially in the Coastal Plains section of South Carolina, accumulations of calcium arsenate in the soil after continued applications for control of the boll weevil (*Anthonomus grandis* Boh.) have caused serious damage to cowpeas and cotton (Cooper et al. 1.).

Because of the importance of soil poisoning studies in general, and in South Carolina in particular, a cooperative investigation was initi-

ated in 1947 by the Bureau of Entomology and Plant Quarantine, the Bureau of Plant Industry, Soils, and Agricultural Engineering, and the South Carolina Agricultural Experiment Station, to provide information on the tolerance of the crops of a typical 3-year rotation to DDT, benzene hexachloride, and toxaphene applied to the soil. The rotation included tobacco followed by a winter cover crop of oats mixed with Austrian winter field peas, cowpeas followed by rye the next year, and cotton followed by rye the third year. The investigation was carried out in Marlboro fine sandy loam on

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AGRICULTURAL CHEMICALS

the farm of the Pee Dee Experiment Station at Florence, S. C.

Experiments were begun in the spring of 1947. The same soil treatments were tested in three experiments. Each experiment was started with a different crop, but the same succession was followed. Tobacco was followed by a mixture of oats and Austrian winter peas, cowpeas the second spring, rye the second fall, cotton the third spring, and rye the third fall. Likewise, rye after cotton was followed by tobacco. In this manner tests were made on all the crops each year.

DDT was applied at 10 and 20 pounds per acre each spring and at 40 and 100 pounds in 1947 only. Cotton did not seem to be affected by the DDT treatment. The only treatment that seemed to affect tobacco was the 100-pound dosage that was applied in 1947 only. This dosage appeared to cause some chlorine injury characterized by glossy brittle leaves in 1947 and to affect the yield and burning quality in 1949. All except the 40-pound dosage of DDT affected cowpeas to some extent, but these effects were not apparent until 1948. The 100-pound dosage significantly reduced the yield of cowpeas in the hull in 1948 and reduced the stand of plants in 1948 and 1949. The 40-pound dosage did not significantly affect the cowpeas in any year, but the yield of hay and peas in the hull was less than that from the untreated check in 1948. Three annual applications of 10 or 20 pounds per acre reduced the stand and growth of the cowpea plants. The 100-pound dosage seemed to retard the growth of oats and Austrian winter peas. Rye was susceptible to injury by DDT, and even a total of 30 pounds applied over a period of 3 years reduced growth under some conditions.

Toxaphene at 20 pounds per acre annually was less injurious than DDT at the same dosage.

Technical benzene hexachloride, containing 12 percent of gamma isomer, was applied annually at 16.7 pounds per acre and at 12.5 pounds with 2.5 pounds of DDT. In 1947,

benzene hexachloride was applied also at 83.3 pounds per acre and at 50 pounds with 10 pounds of DDT. All these treatments affected the flavor of the tobacco in 1947, the only year in which such tests were made. The 50- and 83.3-pound dosages reduced the stand of a root knot-resistant variety of tobacco in 1947, where the plants were transplanted shortly after the insecticides had been applied. In 1948 and 1949 all dosages gave some control of the root knot nematode and in 1949 a slightly higher yield was obtained from the plots that had received the two heaviest dosages in 1947.

In 1947 all dosages reduced the stand of cotton when it was planted shortly after the insecticide had been applied, but in subsequent years none of the treatments harmed the cotton. The benzene hexachloride did not seem to injure rye so much as did DDT, and for some unknown reason it appeared to increase the yield of peas in the hull. Benzene hexachloride, like DDT, did not injure rye following cotton as much as it did rye following cowpeas. The heaviest dosage of benzene hexachloride imparted a reddish color to rye and oat plants, especially during the 1948-49 season.

Westvaco Ups Personnel

Westvaco Chemical Division, Food Machinery and Chemical Corporation, New York, has announced a series of advancements within the sales division, effective January 1.

Arthur F. Smith, previously divisional sales manager for solvents, barium chemicals and magnesol, becomes divisional sales manager, alkalis, succeeding W. N. Wyatt, who has been appointed district sales manager at Chicago.

W. L. Sager, previously assistant district sales manager for New York area, becomes divisional sales manager, solvents and magnesol. He is succeeded by William Holleman, who has been New England sales representative for Westvaco.

J. G. Bronson, who has been assistant divisional manager, Mag-

nesium Chemicals, becomes divisional sales manager, Barium and Miscellaneous Chemicals. Mr. Bronson is succeeded by J. Petersen, until recently at Westvaco's Pocatello elemental Phosphorus plant.

To Study Trace Elements

Rutgers University, New Brunswick, N. J., has announced the beginning of a five year study to determine to what extent deficiencies of trace elements in the soil carry over into plants grown on these soils. According to Dr. Wm. H. Martin, director of the N. J. Agricultural Experiment Station, the study will be financed by an annual grant of \$10,000 from the Herman Frasch Foundation, New York. Dr. Walter G. Russell, Rutgers Biochemistry Department, Dr. Firman E. Bear, Soils Department and Dr. W. R. Robbins, Plant Physiology Department, will supervise the project.

Pennsalt Appts. 2 Mgrs.

Richard A. Snyder and Kenneth W. Montfort have been appointed district sales managers for Pennsylvania Salt Manufacturing Co. of Wash., William J. F. Francis, sales manager of the Special Chemicals Division, has announced.

Mr. Snyder assumes the position of district sales manager of the Industrial Cleaners Division and will head the company's Los Angeles sales office. A chemical engineering graduate of the University of Michigan, he joined Pennsalt in Tacoma in 1946.

Mr. Montfort, formerly sales representative, becomes district sales manager of the Agricultural Chemicals Division and will continue to make his headquarters at the company's office in Portland, Ore. He will supervise sales of agricultural chemicals in Oregon, Washington, Montana, Idaho, Utah, Colorado and British Columbia and other western Canadian provinces. Before joining Pennsalt he was assistant manager of Northwest Wholesale's Chemical Supply Department in Wenatchee, Wash.

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Washington Report

THE National Cotton Council once again is to be congratulated on its annual cotton insect control conference, affording research and industry people an opportunity to plan for the most effective control measures for the coming season. This year, a conference on weed control in cotton was also held, an activity regarded potentially as of great importance to the chemical manufacturer.

The meetings were well attended and the conference issued the usual Federal and State research reports which will serve as adequate guides to the industry for the coming season in producing and distributing these products.

However, many industry spokesmen feel that not enough emphasis was placed on the shortage of sulfur and feel that perhaps consumers were not made to feel the absolute necessity of conserving this vital chemical. Alternate miticides, however, were discussed and recommendations for their use were included in the conference reports.

The Department of Agriculture put out a release early in December initiating the "buy early" program for 1952. Press releases were being sent to all farm papers, farm radio directors as well as land grant colleges asking for cooperation in furthering this program. Members of the industry were also urged to participate in this program which was successful last season.

The press release points out that the outlook for 1952 insecticide and fungicide supplies is hopeful. It urges farmers to avert possible bottlenecks in supplies by securing part of their estimated requirements now and continue with orderly purchases in advance of actual needs.

The release explained that manufacturers and distributors of large quantities of insecticides and related materials require many months for the job of distributing these materials down to the consumer level, and emphasized that the job of distribution cannot be accomplished in the relatively few weeks before and during the growing season. Manufacture and distribution of these materials has become a year-round job which is dependent upon forward planning by manufacturers, distributors and

farmers alike. Although production capacity is generally adequate, storage facilities will not accommodate the quantities of pesticides being made, and this situation threatens to hamper continued manufacturing.

The release also urges that short chemicals be replaced by substitutes. For example, shortages of sulfur, copper and lead require the use of alternate materials wherever possible.

A new process for the production of DDT developed by a Canadian firm, has been announced. This new process substitutes fluosulfonic acid for sulfuric acid as the dehydrating catalyst. It is this step where the chloral is reacted with monochlorobenzene in the presence of the acid. Reports available indicate that this new process brings about higher yields as well as more economical and efficient production.

In addition to other advantages, this new process is effective from the standpoint of sulfur conservation. The use of fluosulfonic acid reduces over-all sulfur consumption to about a quarter of that consumed in the current commercial process. However, the biggest problem posed by the new process is a hazard inherent in handling this acid. It is pointed out that a flesh burn from it combines the action of sulfuric and hydrofluoric acid. However, it is claimed that danger can be minimized by using smaller reactors, instrumentation and more careful controls. It is also said that the corrosion problem can be solved without using critical materials of construction.

As far as it is able to be determined, no American producer at the present time is using this new process or contemplating the use of it.

The new type of hydroponic farming has appeared to be a promising future market for chemical manufacturers. In Florida, it is known that more than 25 commercial growers are supplying local customers with first quality vegetables, and it is believed that this may be sufficiently

expanded so that fruits and vegetables will be available for northern markets.

The Army has a large installation near Tokyo, Japan, where it is said that 80 acres provide troops in Korea with 60 tons of vegetables a day. The new type of farming is also finding great use in the home garden, and it is known that many privately formulated materials are already being sold through this market.

Much has been written and considerable amounts of information made available regarding the recovery of uranium from phosphate rock and products made from it. However, recovery from wet processed phosphoric acid is the easiest method and perhaps of greatest potential significance in making uranium available. Normal superphosphates which are more important tonnage-wise will probably get the greatest share of research attention during the next few years.

Work in this field dates from the discovery a few years ago, that uranium was present in the phosphate rock formations of Florida and the western states. These reports indicated that most marine phosphate rock contains less than a pound of uranium per ton of rock, but the tremendous tonnage mined annually warranted additional research.

Reports indicate that the Atomic Energy Commission is studying the possibility of installing recovery units in every plant using uranium-bearing phosphate rock as a raw material. Many research projects are under way, indicating hope that this new source of uranium will bear the fruits of the expense, time and money put into these research studies.

The Department of Agriculture in its final 1951 report, estimated that this year's cotton crop would be 15,290,000 bales of 500 lbs. gross weight each. The estimate is 481,000 bales below the 15,771,000 bales forecast a month ago. It is larger, however, than last year's small crop of 10,012,000 and well above the ten year average of 12,030,000 bales.

The indicated crop falls slightly below the earlier production goal of at least 16,000,000 bales which had been the indicated goal by Agriculture for this year.

In 1952 the department is calling again for an all out effort to produce (Continued on page 115)

Trying to Beat The Nitrogen Shortage!



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INDUSTRY NEWS

Hercules Advances Forster and Mayfield

ALBERT E. Forster has been elected a vice-president and member of the executive committee of Hercules Powder Company, and Paul Mayfield has been appointed

university an additional two years, to earn a degree in mining engineering.

Mr. Mayfield joined the company in 1925 as a chemist at the



ALBERT E. FORSTER

general manager of the Naval Stores Department, succeeding Mr. Forster to that position.

The election of Mr. Forster to a vice-presidency fills a vacancy created by the recent retirement of Petrus W. Meyeringh.

Mr. Forster joined Hercules in 1925. He was employed in the sales, technical service, and production phases of the Explosives Department, and held responsible executive positions in several Hercules plants and sales offices.

His career kept him in touch with the company's production and sales of naval stores as well as explosives. For the past eleven years he has served as general manager of the Naval Stores Department. He was elected to the board of directors in May, 1941.

He received his early education in San Francisco, Calif., and was graduated from Stanford University with a bachelor of arts degree in geology. He remained at the



PAUL MAYFIELD

Hercules experiment station. He was engaged for a time in sales and technical service work, developing markets for both cellulose and naval stores products made by Hercules. He was appointed to his present post, assistant general manager of the Naval Stores Department, in 1943.

A native of Little York, Indiana, Mr. Mayfield attended schools there and in Salem, Indiana. He earned a bachelor of arts degree in chemistry at Indiana University.

He is a member of the American Chemical Society, Alpha Chi Sigma and Theta Chi fraternities, and is also vice-president and director of the National Agricultural Chemicals Association.

G.C.D. Names Biddison Pres.

Allied Chemical & Dye Corp., New York, has announced the election of Mark M. Biddison as president of its General Chemical Division.

The appointment became effective January 1.

Mr. Biddison succeeds H. O. C. Ingraham who retired at the end of 1951. The new president has been with the company for thirty years, and was a vice-president of the General Chemical Division before being named president.

Cut BHC Dust Prices

BHC dust prices were cut sharply by several leading producers late last month. The reductions followed reports of heavy market accumulations of technical benzene hexachloride, particularly the lower gamma percentage grades. The new price ranges which represent reductions of from 20 to 30% based on previous quotations are as follows:

Dust 3- 5- 0	9½	10¢ lb.
3- 5-40	10½	11¢ lb.
3-10- 0	12	12¼¢ lb.
3-10-40	13	13¼¢ lb.
2-10-40	11½	12¼¢ lb.

The market for technical BHC has ranged approximately from 1.8¢ to 2¢ per pound per gamma unit. On the newer basis for dusts as noted above, some marketers expressed the opinion that this figure would drop to 1.3 to 1.5¢.

Delaney Group to N.Y. City

Congressman James J. Delaney announced that the Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics would hold public hearings in New York City January 10, 11, 14 and 15. The all-day sessions were to commence at 10 a.m. in Room 128, U.S. Federal Court House, Foley Square, Manhattan.

Most of the witnesses scheduled to appear will testify on the precautions taken and testing conducted to determine the harmlessness of cosmetics before they are placed on the market.

Iowa Fertilizer Program

The program for the Fifth Annual Fertilizer Manufacturers' Conference scheduled for Iowa State College January 18, has been announced.

Registration begins at 9 a.m., and at 10, L. C. Dumenil will report on the 1951 corn experiments to open the morning session over which H. B. Cheney will preside. J. T. Pesek will report on recent results on Sources of Phosphorus and H. R. Meldrum on "Top-Dressing Established Meadows."

W. H. Pierre will preside at the afternoon session which will feature a discussion and panel on fertilizer needs. The first, a discussion by J. W. Fitts and G. Stanford, is "Potential Fertilizer Needs Based on Soil Tests and Fertilizer Experiments." A Panel will carry on a discussion of "Needs vs. Use of Fertilizers."

The final event of the day will be a demonstration of a process for curing superphosphate, by Dr. G. L. Bridger, Dept. of Chemical Engineering, Iowa State College.

Hammond Dedicates Plant

Dedication ceremonies for the new Hammond Bag & Paper Company plant at Pine Bluff, Arkansas, were held November 1 and 2. Climaxing a two-day celebration, the dedication officially placed in service the new \$350,000 multi-wall paper bag plant.

This completely modern plant was constructed and placed in service in near record time, with construction starting only last May. With 67,500 square feet of floor space, the plant is a fire-proof, one-story structure, designed specifically to permit 100% expansion in the future. Facilities installed include bag fabricating machinery, printing equipment and modern materials handling equipment.

Hammond, which has maintained production facilities in Pine Bluff since 1947, built this plant to replace its former installation which now has been turned over for use by the Chemical Corps of the Army.



The election of Ernie E. Brown, as vice-president of Arkell & Smiths was announced following a recent meeting of the board of directors. Mr. Brown has been associated with the paper industry for many years, and will make his headquarters at the Company's New York office, 500 Fifth Ave.

MEETINGS

California Weed Control Conference, Cal. State Polytech., San Luis Obispo, Calif., Jan. 22-24.

Western Cooperative Spray Conference, Multnomah Hotel, Portland, Oregon, Jan. 23-25.

Seventh Annual Midwestern Shade Tree Conference, LaSalle Hotel, Chicago, Feb. 13-15.

11th Annual Meeting, Northwest Vegetable Insect Conference, Imperial Hotel, Portland, Oregon, January 21-23, 1952.

Fourth Illinois Custom Spray Operators' Training School, Univ. of Ill., Urbana, January 24 & 25.

Association of Southern Agricultural Workers, Atlanta Biltmore Hotel, Atlanta, Ga., February 4-6, 1952.

Western Weed Control Conference, Mapes Hotel, Reno, Nevada, February 5-7, 1952.

Southern Weed Control Conference (Following Southern Agri. Workers meeting), Biltmore Hotel, Atlanta, Ga., February 6-8.

N. Central State Branch, AAEE, St. Paul Hotel, St. Paul, Minn., March 27 & 28.

National Agricultural Chemicals Association, Spring Meeting, San Francisco, Calif., Fairmont Hotel, April 6-9.

National Fertilizer Association, Greenbrier Hotel, White Sulphur Springs, W. Va., June 16-18.

Pacific Branch, A.A.E.E., Mar Monte Hotel, Santa Barbara, California, June 17-19.

American Plant Food Council, Homestead Hotel, Hot Springs, Va., June 19-22.

Soil Improvement Committee, Pacific Northwest Plant Food Association, Pocatello, Idaho, July 9, 10 & 11.

New Insecticide Plant

The latest and most modern facilities for the manufacturing of agricultural and household insecticides will be a part of the new insecticide plant now being completed by the Chemical Corporation of Colorado in Denver. Suffering a \$100,000 fire last August, at their present site, the company recently acquired the buildings and land previously occupied by the Creager Manufacturing Company.

The plant will employ 75 people on a 24 hour shift basis. Plans are now being made for the operation to house a modern bio-assay chemical laboratory, a greenhouse for testing insecticides on vegetable and grain test plots, and a practical control system for live-stock insecticide formulations.

The Chemical Corporation's present plant is being remodeled and will contain the firm's weed killer manufacturing as well as the company offices. Production at both plants will be under the direction of C. W. Van Pelt, Technical Director.

N. C. Assesses Fert. Tax

A five-cents a ton assessment on fertilizer and feed sold in the State of North Carolina was to go into effect January 1, according to an announcement by the State Agricultural Commissioner, L. Y. Ballentine. In December feed and fertilizer manufacturers were given instructions on how to proceed in making payment. Total funds are estimated to amount to \$125,000 a year.

Midwest Tree Conference

The Seventh Annual Midwestern Shade Tree Conference will be held February 13-15, at the LaSalle Hotel, Chicago, according to Noel B. Wysong, secretary. Included on the program is a paper, "Insects as Carriers of Tree Diseases," by Dr. Roy D. Shenefelt, Univ. of Wisconsin, Madison; a symposium, "Tree Pests;" and a discussion on "Disease and Insect Pests of Evergreens."

AGRICULTURAL CHEMICALS

Dr. Batte Joins Calspray

California Spray - Chemical Corporation, Richmond, Calif., has announced the appointment of Dr. Edward G. Batte to the research



EDWARD G. BATTE

and product development department in charge of livestock pest control. Dr. Batte will be the company's research veterinary entomologist. He holds a degree of Doctor of Veterinary Medicine from Texas A & M College. He has also had field experience in the entomology department of Texas A & M and in the U. S. Army during World War II. Later he was with the Texas State Health Department and Texas A & M in the Department of Veterinary Parasitology. Before joining California Spray-Chemical, Dr. Batte was with the University of Florida Agricultural Experiment Station, continuing his field work as Associate Veterinary Parasitologist.

J. P. Dyer Retires Jan. 1

Phelps Dodge Refining Corp., New York, has announced the retirement of John Paul Dyer, vice-president and director of the firm, effective January 1. He has been connected with the Corporation since 1929, before which time he was with the Chile Copper Co., Chuquicamata, Chile.

In 1936, Mr. Dyer was transferred to the firm's New York office as vice-president in charge of both the Laurel Hill and El Paso refineries. He was also consulting engineer in

the construction of the Montreal Refinery built by Phelps Dodge for Noranda.

Jap Fert. Production Off

Production of nitrogenous fertilizers in Japan has slumped, according to reports from the Japanese Government's Ministry of International Trade and Industry. Due to power shortages, production has declined to only 161,300 metric tons, or 83.5% of the quota of 193,000 metric tons.

Production of phosphoric fertilizers, on the other hand, surpassed the monthly quota by over 6%, with an output of 142,300 metric tons. The reason given for better output of phosphoric materials is that production of these requires but little electric power. The figures given were for the month of October, it being the latest month for which statistics are available.

Turner Asst. Director

Neely Turner, entomologist at the Connecticut Agricultural Experiment Station, New Haven, has been appointed to the post of assistant director of the Station, effective January 1.

Mr. Turner has been associated with the Station for 24 years, joining the staff in 1927 as an assistant entomologist. He became associate entomologist in 1943, and entomologist in 1950. During his Station career, he has become well known for his laboratory researches on the toxicity of insecticides, as well as his development of control measures for several important vegetable insect pests.

He is particularly well known for his work with the Mexican bean beetle, flea beetles and the European corn borer.

Phillips Plant Under Way

Phillips Chemical Co. has started construction on a plant for production of ammonia, methanol and other chemicals on the Houston Ship Channel. The new unit will be located on a 500-acre tract adjoining the company's ammonium sulfate plant.

Shell Names New V-P

G. R. Monkhouse has been elected vice-president of Shell Chemical Corporation's Western Division, according to Jan Oostermeyer, presi-



G. R. MONKHOUSE

dent. The appointment became effective on January 1. Mr. Monkhouse has been with Shell companies for 30 years and was recently general manager of the Western Division before his latest election.

Mr. Monkhouse began his career with Shell in 1921 as a marketing trainee, served three years in England, four years in India and twenty-three years in the U. S. A.

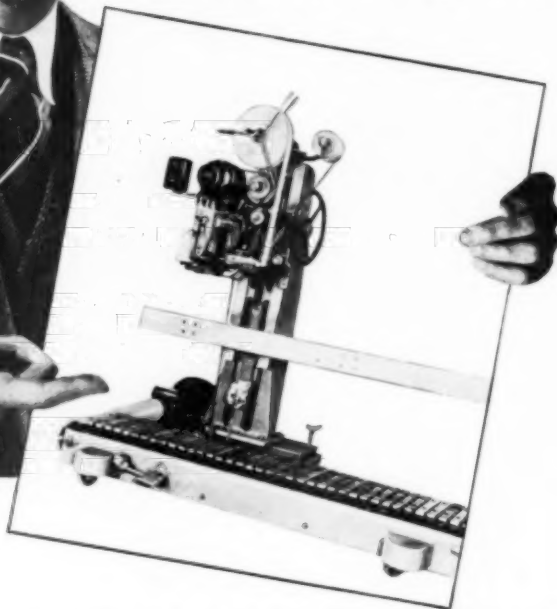
Safety Committee Meets

A permanent committee structure was set up at the December 5th meeting of the National Safety Committee of the fertilizer industry in Chicago. A. B. Pettit, Davison Chemical Corp., Baltimore, was named chairman of statistics and engineering; J. Lauren Shopen, Consumers Co-op Assn., the chairman of publicity; John Smith, Spencer Chemical Co., Kansas City, chairman of the program committee; and Ralph Fraser, Summers Fertilizer Co., chairman of the legislation committee.

Officers of the Safety Committee, elected at the October meeting of the group, are: J. S. Fields, Phillips Chemical Co., Bartlesville, Okla., chairman; John Smith, vice-chairman; and Vernon S. Gornito, Smith-Douglas Corp., Norfolk, Va., secretary.



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Monsanto Soil Conditioner

Monsanto Chemical Co., St. Louis, Mo., has announced a new synthetic chemical compound, "Krilium," said to be effective in improving soil structure. The product, a synthetic polyelectrolyte, not a fertilizer, is expected to be applied as a soil conditioner in home gardens, truck farms and in greenhouses, the company states.

N. Central Branch Meets

J. W. Apple, University of Wisconsin, Madison, secretary-treasurer of the North Central States Branch of the American Association of Economic Entomologists, has announced that the 1952 meeting of the group will be held at the St. Paul Hotel, St. Paul, Minn., March 27 and 28. Details of the program will be announced later, he said.

Dobbin to S. America

Ed Dobbin, president of Edco Corp., Elton, Md., left January 1 on a two week sales trip, by air, to Peru and Brazil.

Hamilton Labs. Formed

Formation of The Hamilton Laboratories, Inc., a Maryland corporation with headquarters at Park Place East, Wood-Ridge, has been announced by M. H. McAllister, President. Hamilton Laboratories has purchased the patents and trade marks of The Hamilton Laboratories, Inc., of Asheville, North Carolina, which corporation is being dissolved.

The successor company at Wood-Ridge will market the same complete line of specialty organic mercurials and medical phenyl mercuric compounds as developed by the Asheville company.

R. T. Vanderbilt Co., Inc. will represent the new firm exclusively for the sale of all of the organic mercurial products formerly offered by the Asheville concern under the trade mark "Merfenelopes," to the pulp and paper, and paper-converting industries of the U.S.A. and Canada.

Officers are: M. H. McAl-

lister, president; George W. Taylor, vice-president and treasurer; and Frank Sheara, secretary.

Names Wilson Plant Super.

Vance N. Wilson has been named superintendent of the Bryan,



VANCE N. WILSON

Texas, plant of the Pennsylvania Salt Manufacturing Co., the firm has announced. Mr. Wilson assumes production duties formerly carried out by Howard L. Teer, Pennsalt's district manager for agricultural chemicals. Appointment of the new superintendent makes it possible for Mr. Teer to devote all his time to selling activities. The Bryan plant manufactures calcium arsenate and organic cotton insecticides and serves as a distribution point for other Pennsalt agricultural chemicals.

New N Process Patented

Wisconsin Alumni Research Foundation, Madison, Wis., has been awarded a patent on an improved process for making nitrates for fertilizers. The patent, No. 2,578,674, was issued to Farrington Daniels, Madison, William G. Hendrickson, San Jose, Calif., and Elton G. Foster, Wilmington, Del.

A pilot plant for the "Wisconsin process" is now producing a ton of 60 percent nitric acid each day in San Jose, Calif., and another plant is expected to be constructed soon at Sunflower, Kansas.

The process for the recovery of nitrogen dioxide from a gas mixture containing nitrogen, oxygen

and a small amount of nitrogen dioxide, comprises passing the mixture in a dried and cooled state through a mass of absorbent silicon dioxide. This results in an absorption of the nitrogen dioxide in the silicon particles from which it is later separated.

Texas Fertilizer Meeting

The Texas Fertilizer Conference was to be held January 8 & 9 at Texas A. & M. College, College Station, with a full program of discussions on fertilizer and allied subjects. The first day was to be under the chairmanship of G. G. Gibson. C. N. Shepardson was to welcome the group, and D. C. Shallenberger was to respond. The program was to feature reports on the fertilizer outlook for 1952, with Mr. Shallenberger as chairman; and the agricultural outlook for 1952, by G. McHaney. Fertilizer recommendations for 1952 were to be given by M. K. Thornton.

J. E. Adams was to be chairman of the afternoon session which was to hear talks by J. B. Page, R. C. Garrett, J. R. Johnston and R. W. Scanlon. The banquet was scheduled for Tuesday evening, with Director R. D. Lewis addressing the group on "Looking Ahead."

Dr. J. F. Fudge was to be chairman of the Wednesday morning session featuring a panel on "Progress in Fertilizer Research" by various members of the staff of the College. M. K. Thornton was scheduled to talk on the A. & M. soil testing laboratory, to complete the program.

New Hough Representative

Gene Thomas has been appointed District Representative of The Frank G. Hough Co., Libertyville, Illinois, for an area covering the states of Washington, Oregon, Idaho, Montana and Wyoming. He will work with the Hough distributors in these states in the application of Hough "PAYLOADER" tractor-shovels. Mr. Thomas has been with the Hough organization for 18 months training for his new duties.

Proved Performance **SINOX PE**

A Dinitro Pre-Emergence Spray For Weeds in Cotton Fields

Sinox sprays are the original dinitro herbicides and have been used successfully for 13 years as selective, pre-harvest and general contact weed killers. SINOX PE is the latest member of the SINOX family and has been thoroughly tested and approved as a pre-emergence spray for weeds in cotton.

IF your marketing area includes the Southeastern and Gulf States, SINOX PE should prove to be a profitable item for you to stock and sell this spring.

With the Government again calling for a 16,000,000 bale cotton crop in 1952, many growers are planning on using SINOX PE to help increase their profits per acre. SINOX PE has been thoroughly tested in the Southeastern and Gulf States and was used commercially last year to kill weeds the easy chemical way at a tremendous saving in time and effort over hoeing.

SINOX PE is a pre-emergence spray and supplements present cultural practices. It gives excellent control of Mustard, Lamb's Quarter, Ragweed, Pigweed (red root), Purslane, Wild Radish, Chickweed, Smartweed, Wild Lettuce, Shepherd's Purse, Henbit, Wild Buckwheat, etc. Results have shown that SINOX PE will retard annual grasses from 4 to 5 weeks.



STANDARD AGRICULTURAL CHEMICALS, Inc.

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Illinois Custom Spray School Jan. 24, 25

PROGRAM plans for the Fourth Custom Spray Operators' Training School at the University of Illinois were practically complete at press time. The school, scheduled to be held January 24 & 25, will feature talks by entomologists, agronomists and herbicide specialists and a panel of commercial operators discussing mutual problems.

Dr. J. Nelson Spaeth, Head of the Department of Forestry, U. of Ill., will preside at the first session, January 24. Preharvest sprays on soybeans, legumes and corn will be discussed by F. W. Slife, J. L. Cartter and George S. Cooper of the Univ. of Ill., and Oliver Lee, Purdue University, will talk on brush control.

Dr. L. L. Coulter, Dow Chemical Co., Midland, Mich., will present a paper comparing low volatile and standard esters for brush control; Oil-water emulsions for dormant sprays, and comparison of basal treatment, foliage sprays, frilling and stump treatment for brush control.

In the afternoon, Dr. Harlow B. Mills Chief, Ill. Natural History Survey, will preside, with the program continuing the discussion on brush control. J. B. Turner, farm adviser, Vandalia, Ill., Dean Roy, salesman for Illinois Fruit Growers' Exchange, Carbondale, Ill. and possibly a third speaker, will discuss "Practical Brush Control." George Pickard, U. of Ill. will discuss nozzle wear experiments and J. H. Bigger, Illinois, will report on the insect situation.

C. R. Weaver, Ohio Agricultural Experiment Station, Wooster, will report on Spittle Bug Control in Ohio and Clarence E. White, Univ. of Ill., will talk on control of the pest in Illinois. W. N. Bruce and E. B. Early, U. of Ill., will speak on "New Things in Livestock Insect Control" and "Spray Applications of Fertilizers," respectively.

The final morning of the meeting will be under the chairman-

ship of Dr. M. B. Russell, U. of Ill. Included on the program will be a talk by K. P. Buchholtz, Univ. of Wisconsin, on "The Use of MCP, 2,4-D and Dinitros in Small Grains with Legume Seedlings;" and L. M. Stahler, U.S.D.A., Columbia, Mo., on "Livestock Poisoning from 2,4-D Sprayed Weeds." The meeting will end with talks by W. O. Scott and F. W. Slife, U. of Ill., with "Latest Weed Control Recommendations" and "Around the Calendar with Herbicides," respectively. The meeting is scheduled to terminate around noon, according to H. B. Petty, Extension Specialist in Entomology for the Illinois Natural History Survey, in charge of arrangements.

J. T. Howard Dies

James T. Howard, formerly chief seed and fertilizer inspector at the Massachusetts Agricultural Experiment Station, Amherst, died November 27 at the age of 74. He had retired in 1946 after nearly 40 years of service for the state. Since his retirement he had devoted his time to chemical and bacteriological research at the Howard Research laboratory of his son, Harlan.

Penick, NYQ Meet Jointly

S. B. Penick & Co., and the New York Quinine & Chemical Co. held a joint four-day sales meeting in New York City in December. Sessions were held at the Railroad-Machinery Club, and the meeting closed with an all-day tour of plant facilities in New Jersey.

All representatives of both companies were present to hear a program covering every phase of operations, with all departments participating. After each presentation the sales staff took part in an informal question-and-answer discussion.

S. B. Penick Sr., chairman, spoke on the relationship of the two companies to the various national associations and foundations of the industry. S. B. Penick Jr., president,

closed the meeting with a brief talk.

The committee in charge of arrangements consisted of Harold Meyer and Ed Allison of Penick; Rudy Neptun and Barclay Mackinnon of N. Y. Q.

Burt Chem Eng. Pres.

William I. Burt, vice-president—manufacturing, of B. F. Goodrich Chemical Company, Cleveland, was elected president of the American Institute of Chemical Engineers for 1952, at the group's recent 44th annual meeting at Atlantic City, N. J. The organization is composed of American chemical engineers with a membership of over 12,000. It was founded in 1908.

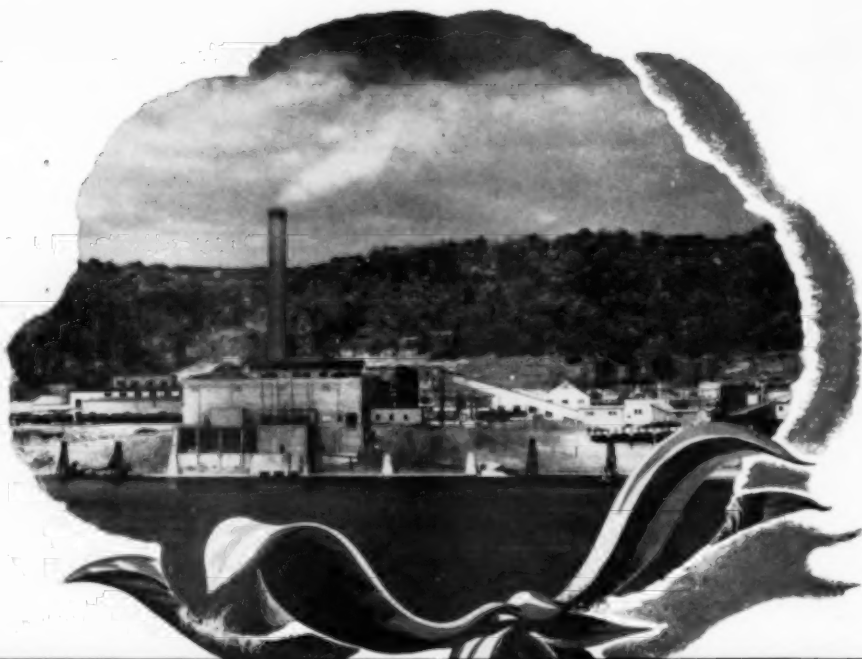
Davison Names Nicholson

Appointment of Finley C. Nicholson to the newly-created post of manager of operations of The Davison Chemical Corporation has been announced by M. G. Geiger, vice-chairman of the board. He will be in charge of all company production except for the Mixed Fertilizer Division. A graduate of Purdue in chemical engineering, Mr. Nicholson has been with Davison in various capacities since 1942.

NW Veg. Insect Conference

The Pacific Northwest Vegetable Insect Conference will be held January 21-23 at the Imperial Hotel, Portland, Oregon, according to an announcement by H. S. Telford, chairman of the conference. The first two days of the meeting will be closed sessions for both state and federal entomologists as well as for public service workers in Canada.

On the morning of the 23rd, however, an open session will be held where summarized reports will be presented. Industry representatives will be invited to attend this meeting. Immediately following this the Western Cooperative Spray Project will begin its meeting, which, like the former conference, will start with closed session. An open meeting is set for Friday, with industry representatives in attendance.



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Benzene Hexachloride, the effective insecticide for use especially in cotton pest control, is manufactured at this large plant in Natrium, West Virginia.

Columbia-Southern, a basic producer of chlorine and a major producer of BHC, maintains an extensive research staff that assures Columbia-Southern customers not only highest quality, but BHC in the form most easily handled by the processor.

Columbia-Southern supplies BHC in technical grade only to manufacturers of BHC dust concentrate or BHC cotton dust. *Columbia-Southern does not supply dust concentrates or finished dusts.*

Technical BHC, with a Gamma Isomer content of 12% to 15%, is packed as flakes in 200 lb. drums. The new cost-saving solid form of BHC, with a Gamma Isomer content of 30% to 45%, in 100 lb. drums, is being offered in limited quantity.

Processors are invited to write for additional information.

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AGRICULTURAL CHEMICALS

North Central Weed Control Meeting



At the North Central Weed Control Conference, held at the Biltmore Hotel, Oklahoma City, Okla., two leaders in weed control were honored. They are (l. to r.): E. D. Anderson, secretary, National Sprayer & Duster, Assn., Chicago; chairman of the election committee; A. B. Hagen, Murray County, Minn. agricultural agent; Herbert Hokanson, weed supervisor, Roberts County.

S. D., winners of awards for their weed control and educational work, respectively. At the right is Dr. E. P. Sylwester, Iowa State College, president of the N. Central group.

The meeting was attended by representatives of the 14 states and 3 Canadian provinces included in the North Central area.

Hudson Opens New Mill

The second unit of Hudson Pulp & Paper corporation's kraft mill at Palatka, Fla., a \$10,000,000 addition that will double the plant's capacity, was dedicated on December 6. Bringing Hudson's total capital investment at Palatka to more than \$22,000,000, the new plant will boost total daily production to 400 tons of finished, unbleached kraft, much of which will be used in the manufacture of multi-walled bags.

Davison Buys Mich. Plant

Acquisition of the Lansing, Michigan, fertilizer plant of the Michigan Fertilizer Co. of Sandusky, O., by The Davison Chemical Corporation of Baltimore, has been announced by W. N. Watmough, Jr., vice-president in charge of Davison's Mixed Fertilizer Division.

The change was effective December 1, and production and distribution from the plant continued unchanged. The unit is now known as the Lansing Plant of The Davison Chemical Corporation, with Bernard C. Manker as manager. The Michigan Fertilizer Co. will continue to operate its pesticide business.

The Lansing plant has a total employment of 75 to 90 people according to season and an annual capacity of 65,000 tons of mixed fertilizer. Mr. Watmough said that practically the entire Michigan Fertilizer organization, including sales and office personnel as well as the plant workers, had been retained.

Mr. Manker, Davison's manager for Lansing, has been 35 years in the fertilizer industry, 23 of them with Michigan Fertilizer, of which he has recently been sales manager.

Other appointments of former Michigan Fertilizer employees to key positions in the Davison organization at Lansing include Frank Parmelee, supervisor of sales; William N. Brinson, plant superintendent, his previous position; and Harold Houck, who continues as office manager. In addition, Vance G. Vashbinder of Davison's Alliance, O., branch has been transferred to Lansing as assistant manager.

The Lansing plant is the eighth in the Davison organization to be devoted to fertilizers. In addition, the main plant of the corporation at Baltimore produces superphosphates and mixed fertilizers, and extensive phosphate rock mining and processing facilities are maintained in the Bartow-Lakeland area of Florida. The other fertilizer plants are at Columbus and Alliance, O.; Nashville, Tenn.; New Albany, Ind.; Gretna, La.; Perry, Iowa, and Savannah, Ga.

Lou Jones, Fulton, Retires

Fulton Bag & Cotton Mills has announced the retirement, effective January 1, 1952, of Louis J. Jones, better known as "Lou," associated with the company since 1908. He served as sales manager of the St. Louis plant for many years, and is widely known in the trade. His successor will be A. C. "Art" Jones, his nephew, who has also been connected with Fulton Bag in St. Louis for a long period of time.

Stauffer Completes New Laboratory



Stauffer Chemical Company has announced the completion of a new laboratory adjacent to its present plant at Chauncey, N. Y. where additional facilities for pilot plant

work are maintained. Dr. J. T. Baschour will be in charge of the laboratory. The new laboratory has 16 lab rooms and offices. Construction was started in July, 1950.



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PENNSALT DB-50—A 50% DDT dust base, for reformulating into various combinations.

PENNSALT WB-50—A 50% DDT wettable powder base, for use as a water suspension.

PENNSALT CATTLE SPRAY—Special 50% DDT wettable powder, containing spreaders and stickers to wet out animals' hair.

PENNSALT DDT EMULSION CONCENTRATES 25 and 34—Emulifiable solutions, ready for "cutting" with water to suitable strengths for field use. Contain 25% (2 lb./gal.) and 34% (3 lb./gal.) DDT respectively.

ALSO—BHC TECHNICAL 36 / • BHC WETTABLE W-12 • HI-GAMs: technical lindane and formulations • PENPHOSs: (Parathion) • SODIUM CHLORATE • PENITEs: 6 (Sodium Arsenite) • CALCIUM ARSENATE • KRYOCIDEs: natural cryolite • 2,4-D • TCA and other agricultural chemicals.

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PENTECH H—for making 50% dust and then further diluting to field strength. Costs less than prepared bases, if you have suitable mixing and milling equipment. Save on handling and storage charges. A friable DDT, hammermilled, bulk density 37.5 lb. per cubic foot. Typical particle size:

99% through 20 mesh
90% plus or minus 10% through 60 mesh
75% plus or minus 20% through 100 mesh

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PROGRESSIVE CHEMISTRY FOR OVER A CENTURY

Northeastern Weed Group

Elects Minarik in 6th Meeting

THE sixth annual meeting of the Northeastern Weed Control Conference was held at the New Yorker Hotel, New York City, January 2-4, featuring scores of technical papers and reports on 1951 tests of various herbicides. The meeting was well attended by representatives from all the states included in the northeastern area and many from surrounding states. Total registration was about 350.

Dr. S. M. Raleigh, N.E.W.-C.C. president, Pennsylvania State College, was chairman of the opening session Wednesday morning. Paul J. Linder, U.S.D.A., Beltsville, Md., reported a method for studying movement and persistence of three herbicides following their application to soils. A thin concentrated layer of herbicides near the surface of the soil was most effective as a weed killer. Increasing the volume of liquid from 40 to 100 gallons of water or the addition of a wetting agent failed to increase penetration of the soil by the weed-killing chemicals.

C. E. Minarik, Camp Detrick, Md., presided at the afternoon session of Wednesday. Mr. Minarik presented a movie showing the behavior of drops impinging on leaves of different species.

The possibility of livestock poisoning from herbicide-treated vegetation was discussed by Stanford Fertig of Cornell, who summarized chemical analyses of treated and untreated plants and concluded there is justification for some caution in spraying areas where livestock are grazing and weeds are numerous.

R. B. Carroll of the Boyce Thompson Institute for Plant Research reported that riboflavin commonly known as vitamin B was the most efficient of several chemicals capable of counteracting the effects of 2,4-D on plant seedlings.

The commercial control of quackgrass prior to cabbage or cauliflower planting is possible, accord-

ing to a paper presented by R. D. Sweet and S. K. Ries of Cornell. A combination of fall plowing, early spring application of sodium trichloroacetate at 25 pounds per acre and thorough harrowing was successful in reducing quackgrass.

Mechanical cultivation of chemically weeded potatoes greatly increased their yield but for the second consecutive year the total bushels harvested was still below that of the normally cultivated plots. Normally cultivated potatoes yielded 135 more bushels per acre than potatoes treated with pre-emergence applications of herbicides in tests conducted by J. Howard Ellison of Cornell University.

Robert Frans and Richard Aldrich of Rutgers determined the persistence of various quantities of sodium arsenite in different textured soils and presented data to show that this herbicide does not remain in soil as long under eastern U. S. climate conditions as under western conditions. Combinations of herbicides had considerable merit as soil sterilants.

Thursday's sessions covered horticultural crops and agronomic crops; turf. Charles J. Noll, Pennsylvania State College was chairman of the former, and M. P. Trevett, Univ. of Maine, the latter.

Two afternoon sessions were under the chairmanship of H. I. Yowell, Ems Laboratories, Elizabeth,

N. J. and Gilbert H. Ahlgren, Rutgers University.

At a luncheon business meeting on Thursday, the Conference voted to support a national weed conference which would be held on alternate years, beginning in 1953. Such a gathering would be held somewhere in the midwest in order to centralize the location and make it more accessible to representatives of the present four regional weed control conferences. (Northeastern, North Central, Western and Southern). The Northeastern group also voted to hold its own meeting as usual, regardless of a national meeting.

Toxicity Discussed

A SYMPOSIUM on "Toxicity of Herbicides" was held Thursday afternoon, with Dr. P. W. Zimmerman, Boyce Thompson Institute, Yonkers, N. Y., as chairman. Appearing on the panel were Dr. C. J. Willard, Ohio State University, Columbus; S. N. Fertig, Cornell University, Ithaca, N. Y.; B. H. Grigaby, Michigan State College, E. Lansing; V. K. Rowe, Dow Chemical Co., Midland, Mich.; and R. H. Beatty, American Chemical Paint Co., Ambler, Pa. Dr. C. L. Hamner, also of Michigan State College, slated to be on the panel, was unable to attend.

Dr. Fertig's remarks were similar to those made in his earlier talk regarding the poisoning of livestock through the application of herbicides. He stated that the addition of 2,4-D to some plants may increase their nitrate content enough to make the otherwise harmless plant toxic to the animal eating it. He also pointed out that much additional research is needed to determine the cause of occasional reports of livestock injury from herbicide application.

Dr. Willard warned that a logical sense of perspective should be maintained, since there is a strong tendency to exaggerate any damage done through agricultural chemicals. He said, for instance, that in New York State alone, some 14,000 cows a year die from "hardware disease," that is, from eating nails, wire and

NEWCC Names Officers

Officers elected at the Northeastern Weed Control Conference were as follows:

President: C. E. Minarik, Camp Detrick, Frederick, Md., succeeding S. M. Raleigh, Pennsylvania State College.

Vice-president: R. F. Beatty, American Chemical Paint Co., Ambler, Pa., succeeding Mr. Minarik.

W. C. Jacob, Long Island Vegetable Research Farm, Riverhead, N. Y., was re-elected secretary-treasurer of the Conference.

New Sulfur Order by NPA

A new sulfur order was issued by NPA on December 29, to achieve a balance between the supply and demand of sulfur. The newly issued M-94, is an amendment of order M-69, the basic sulfur order.

The new amendment restricts sulfur consumption to 90% of the calendar year, 1950, and makes it possible for NPA "to fully supply military and defense requirements for sulfur through the issuance of directives to sulfur suppliers." The old order, M-69, issued in June, 1951, limited use of sulfur to 100% of 1950's consumption.

Provisions of the new sulfuric acid order M-94 are designed to prevent any serious maldistribution of sulfuric acid by requiring producers to maintain the same ratio between sales and captive use of their total production of sulfuric acid which they maintained in the calendar year 1950.

The effect of the order, NPA explained, will be to require each producer to offer for sale each month a percentage of his scheduled monthly production of sulfuric acid equal to the percentage which he sold in 1950, unless otherwise authorized by NPA.

New Monsanto Test Farm

Monsanto Chemical Company's Organic Chemicals Division plans to establish an experimental farm in the St. Louis area to test agricultural chemicals. The tests will include fungicides, herbicides, insecticides, defoliants and plant foods, the company states. The new project is not to replace present facilities for such tests, according to J. L. Gillis, general manager of the division.

Western Weed Meeting

February 5-7 are the dates set for the thirteenth meeting of the Western Weed Control Conference at the Mapes Hotel, Reno, Nevada. A full program of technical papers on herbicides, research reports, and a discussion on regulation of pest con-

trol operators is planned. The annual banquet is scheduled for the evening of February 6.

Among those to appear on the first day's program, are F. L. Timmons, USDA, Logan, Utah; A. S. Crafts, Univ. of Calif., Davis; L. W. Rasmussen, Pullman, Washington; J. M. Hodgson, USDA, Meridian, Idaho; R. L. Warden, Bozeman, Montana; C. I. Seely, Moscow, Idaho; Virgil H. Freed, Corvallis, Oregon and W. Dean Boyle, Bur. of Reclamation, Prosser, Washington.

The program of Feb. 6, will have as chairman, B. J. Thornton, Ft. Collins, Colo. Among the speakers for this session will be J. K. Holloway, Albany, Calif.; H. R. Offord, USDA, Berkeley, Calif.; H. R. Hostick and W. T. Moran, Bur. of Reclamation, Denver, Colo. and E. T. Osborn, USDA, Denver. W. J. Hanson, Dow Chemical Co., Seal Beach, Calif., will talk on chemical formulations.

The final day's program will include talks by L. M. Stahler, USDA, Columbia, Mo.; Allen B. Lemmon, chief, Bur. of Chemistry, State Dept. of Agriculture, Sacramento, Calif.; W. L. Klatt, Pacific Coast Borax Co., Los Angeles; and C. E. Fisher, agronomist, Texas Experiment station, Spur, Tex.

Court Decision for S-W

In a decision recently published, the U. S. Court of Appeals of the 8th District, affirmed the judgment of the U. S. District Court for the district of eastern Arkansas in favor of the Sherwin-Williams Company in a case opened by nine cotton growers who sought to recover damages from S-W for injury to their cotton through application of the company's 2,4-D product, "Weed-No-More."

The nine actions were consolidated for the trial. The chemical was applied, in an oil solution, by airplane for control of weeds in rice in a "mixed-crop" area.

Evidence submitted at the trial indicated that 2,4-D in an oil solution is not inherently dangerous. Expert witnesses told the court that

"literally thousands of acres are sprayed safely every year."

The court also observed that "2,4-D standing alone, has no peculiar drifting qualities; such qualities depend upon the carrier which is employed. In the Chapman (one of the plaintiffs) case, that carrier was a powder; in the present case, it was a liquid."

NACA Names Dates

Dates for the annual spring meeting of the National Agricultural Chemicals Association have been set, according to Lea S. Hitchner, executive secretary-treasurer of the Association.

April 6, 7, 8 & 9 are the days set aside for the convention to be held in San Francisco's Fairmont Hotel.

Program details have not yet been announced, but the Washington office of the Association says that the meeting will include representatives of industry, state and federal agencies, and law enforcement bodies.

Clemson Short Course

A three-day school on the use of agricultural chemicals has been announced for January 28-30, by Clemson Agricultural College, Clemson, S. C. The proper use of insecticides, fungicides, livestock remedies, rodenticides and weed killers will be stressed, according to W. D. Farrar, head of the Clemson Dept. of Entomology and Zoology.

The first day will comprise an insecticide & fungicide school; the second day, a meeting of airplane operators and a school for pest control operators. The final day will be a continuation of the PCO school.

An invitation to all distributors, dealers, company representatives, salesmen, custom operators and farmers has been extended by Dr. H. P. Cooper, director of the S. C. Agri. Experiment Station, and D. W. Watkins, director of the Clemson Extension service. College officials said they expected a large attendance at the short course.

To Increase Output 110%

The Pennsylvania Salt Manufacturing Co., Philadelphia, has announced it will increase production capacity for synthetic anhydrous ammonia at its Wyandotte works by approximately 110 per cent. The new facilities will be added to Pennsalt's present ammonia plant at an estimated cost of \$2,200,000. Construction will begin early in 1952 and the plant is scheduled for completion early in 1953.

The new unit will use the Casale process, a high-pressure system developed in Italy.

COTTON INSECTS

(Continued from page 51)

A total of 18,185 insect counts or field records were made in these areas during the cotton growing season.

A report summarizing research during 1951 was issued by a group of more than 60 entomologists and associated technical workers who had met Sunday and Monday prior to the general conference. The newer insecticides mentioned were dieldrin which was used experimentally for cotton insect control in many locations previously, heptachlor which was used experimentally in 1951 for the first time, and parathion which found greater use in 1951 than in previous years. Newer insecticides tested for the first time in 1951 included "Systox," a new systemic and "Compound 269," described as a stereoisomer of dieldrin, and "EPN," an organic thionophosphate. The report also showed that several organic insecticides applied in spray form were widely used last year and noted that results during the last 3 years have shown that concentrated sprays of organic insecticides applied with ground equipment and airplanes gave control of cotton insects equal to that obtained with dusts.

The general report also described experiments with the three newer materials mentioned above, and warned against careless use. The State recommendations generally were much the same as those issued

previously, although some of the newer materials were contained in the new recommendations for 1952.

The entomologists' report also emphasized the sulfur shortage and recommended that sulfur be deleted when possible from local recommendations. The report further pointed out that parathion, TEPP, aramite and other organic sulfur compounds can be used effectively as alternates.

Weed Conference Held

A new departure for the conference was the issuance of general guides for the use of chemicals for weed control. The guides were prepared after an all day technical conference held Thursday following the general meeting, and included the work of research workers from State and Federal Experiment Stations as well as from industry. These sessions were attended by more than a thousand persons and featured the issuance of general guides for the use of dinitro compounds at planting time for pre-emergent control of weeds and grass in cotton and for the application of herbicidal oils for post-emergent control.

The report stated that when pre-emergence materials are used they should be applied at planting time. As a rule this gives protection from 3 to 5 weeks. The dinitro compounds are applied on the top of the row, thus reducing or eliminating hand-hoeing. Application rates vary from a pound and a half to three lbs. per acre.

In addition to dinitro compounds, "Chloro IPC" was particularly promising as a pre-emergent material in 1951 tests.

For successful post-emergence chemical weed control, herbicidal oils should be applied while weeds and grass are still young and tender. Herbicidal oils usually are applied 4 to 6 weeks after planting at intervals of at least 5 days apart, and at the rate of about 5 gals. to the acre. In post-emergence application, leaves of the cotton should not be sprayed since the plant may be killed. The report emphasized further that use of chemicals to control weeds

and grass in cotton is a highly precise operation. The researchers recommended that farmers try the process on a small percentage of their cotton acreage until sufficient experience is gained.

Nearly 100,000 acres of cotton were treated chemically for weed control in 1951. Next year's application is expected to top 300,000 acres. It was predicted by one speaker that in 5 years at least 5 million acres of cotton would be treated with chemical weed killers, representing about one-fifth of the average planted cotton acreage.★★

"DEBUGGER"

(Continued from page 61)

printing a pattern of the radiation frequency on the card.


No other plant except the one related to the key, say the inventors, will receive the treatment, although when a second plant touches the first plant, the key for both plants will be obtained, and both will receive the treatment. If a whole field is to be treated, an aerial photograph is taken on ordinary film, and the film serves as the key for the whole field. To provide the usual entomological check on the experiments, one corner of the negative can be clipped off. Thus, it is explained, the plants appearing in that corner of the field will receive no treatment, and will provide a check plot. According to the inventors, distance is no particular bar to effective treatment, it being claimed that broadcasts of insecticidal treatments can be made to areas a hundred or more miles away.

The device itself is a small aluminum box, similar in appearance to some portable radios. Dimensions are approximately 12" x 4" x 8". The instrument has only four connections, two of which carry wires to a copper plate on which the key plate referred to above is placed. The other two connections are presumably power leads from the power source. A radio antenna protruding from the top of the case completes the equipment.



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Trained observers who have inspected the machine, or listened to the story of its supposed method of operation, have been highly sceptical, and have had no difficulty at all in spotting many inconsistencies. They point out that it is difficult to conceive how a radiation pattern could be transmitted to a card through a pencil, or how the thousands of individual patterns from a field of corn, for example, could be recorded on a photographic plate. Nor can they see just how it would be possible for these individual patterns to be picked up from a card or a photographic negative merely by laying this negative on a copper plate. Just how placing a minute amount of an insecticide on top of the plate could result in modulating the plant frequency and killing the insects thereon, is another point that is difficult for the real experts in the pest control field to grasp. Yet it all seems very obvious and logical to the inventors.

Public Well Posted

THE device has naturally attracted much attention in the general press, as many newspapers are perennially suckers for pseudo scientific bunkum. The *Denver Post*, for example, in its issue of June 5, 1951, carried a story captioned "Arizona Farmers Convinced—Low Cost Electronic Bug Chaser Saves Cotton Fields." Stewart Nicholas, of Cortaro Management Co., Marana, Colo., is reported in the article as stating "We investigated the machine and came to the conclusion that it works with 100 per cent success." The *Farm Bureau Mirror*, publication of the Pennsylvania Farm Bureau Cooperative Association, Harrisburg, Pa., has carried at least three major articles on the device, in its issues of March, 1950, and March and June, 1951. The latest one carried the good news to Pennsylvania Farmers that "radioed poisons might be ready in '52." What are conservatively described as "clincher" experiments are reported to be under way in seven Pennsylvania counties, which "might mean that pests and disease can be blasted from farm crops here next

AGRICULTURAL CHEMICALS

year by radio broadcasts on a commercial basis." The article notes particularly that cost of the process is but a small fraction of the cost of conventional spraying with agricultural insecticides. The claim is made that in tests by B. A. Rockwell, director of research of Pennsylvania Farm Bureau, potatoes given the electronic treatment at distances up to 200 miles yielded 13 to 22 per cent better than those in nearby check plots which had been treated by conventional spraying methods. In 1950 tests, according to Mr. Rockwell, European corn borer was controlled up to 65 per cent by the broadcasts, and caterpillars on walnut trees were killed or driven off successfully by the process in both 1949 and 1950.

Even the inventors, however, do not claim that the process can give such results on every crop, for in the March, 1951 article in the *Farm Bureau Mirror* Mr. Rockwell is reported as admitting that attempts to treat cabbage were completely ineffective, and that tests on fruit trees met with little success.

The electronic device received rather caustic editorial comment, however, in the September 15 issue of the *Arizona Farmer* which ran a story captioned "Electronic Debugger Flops—Promoter of Magic Black Box Leaves Texas Panhandle When Cotton Farmers Find It Didn't Work." The article indicated that one farmer who had tried out electronic pest control on his 100 acres reported "It cost me a hundred bales of cotton."

The Lubbock *Avalanche-Journal* also ran a highly critical article, captioned "Bug Control Man Leaves, Leaving Bugs Behind Him." The author, Wm. McCann, reported he had queried farmers about the results obtained and "they agreed unanimously it was a flop."

So far as we have been able to determine, no disinterested observers have been able to duplicate the results obtained by the inventors and promoters of the Ukaometer. As a matter of fact we have seen no favorable results of any kind

based on work by trained entomologists, nor by any disinterested and unbiased scientists. Quite to the contrary, whenever the device is so tested, the results seem uniformly negative. Dr. G. P. Wene of the Weslaco Agricultural Experiment Station made counts on corn treated by this method in an attempt to control earworm, and found the treatment to be worthless. The Extension Service, College Station, Texas, so reported in December, 1949.

A report by Herbert Spencer, Division of Fruit Insect Investigations, BEPQ, St. Lucia, Fla., dated May 18, 1950, showed the method to be of no value in the control of purple scale on citrus trees.

During 1950 W. A. Stevenson, in charge of the Cotton Insect Investigations Laboratory at Tucson, Arizona checked insect infestations in cotton fields supposed to be under "treatment" by the Ukaometer. He is reported to have found that while field checks early in the season disclosed that insect populations were low, this was also true in the remaining cotton fields in this area where no electronic or insecticide treatments had been made. When later in the season the electronically treated fields were again examined, they were found to have developed a high insect population, with considerable damage from bollworms noted. These fields were promptly dusted with DDT-BHC-sulfur and good controls obtained.

STATE LAWS

(Continued from page 57)

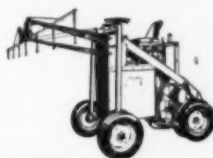
Colorado¹⁰

Scope: Commercial fertilizers are defined to include mixed fertilizer only of nitrogen, phosphoric acid and potash quality, either singly or in combination. Fertilizer materials are defined to include any substance containing water-soluble nitrogen, available phosphoric acid, or water-soluble potash used primarily as a plant nutrient and for compounding mixed fertilizer, except unmanipulated animal and vegetable manures.

Registration Fees: The registration fee is \$25.00 for the first brand, \$10.00 for each succeeding registration of same, and

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\$2.50 for each analysis under each separate brand. All registrations expire annually on June 30.

Tonnage Reports and Fees: In addition, an inspection fee is imposed at the rate of 2¢ per ton. The fee is based on semi-annual tonnage reports required in January and July. On individual packages of five pounds or less or bottles of one quart or less there may be paid in lieu of the tonnage fee an annual inspection fee of \$10.00 for each brand.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the guaranteed analysis. The analysis must show the minimum percentages of total nitrogen, available phosphoric acid, and soluble potash.

Unacidulated mineral phosphatic materials and basic slag must be guaranteed as to both total and available phosphoric acid, and the degree of fineness. In the case of bone, tankage, and other natural organic phosphate materials, only the total phosphoric acid need be guaranteed.

The Commissioner may permit or require the potential basicity or acidity, expressed in terms of calcium carbonate equivalent in multiples of one hundred pounds per ton, to be guaranteed.

Idaho¹¹

Scope: Commercial fertilizers are defined to include allumite, gypsum, lime, phosphate in its natural form, and any other commercial fertilizer sold for fertilizing, manurial, soil enriching or soil corrective purposes. The law does not

apply to animal manure which has not been artificially treated.

Registration Fees: Under a 1931 amendment, the annual registration fee is \$25.00 per brand, payable on or before December 31.

Tonnage Reports and Fees: In addition, a license fee is imposed at the rate of 10¢ per ton. The collection of the fee will be provided for by regulation.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must show the minimum percentages and sources of nitrogen in available form, potash soluble in distilled water, available phosphoric acid and the total phosphoric acid content. The content of any other material from which a benefit is claimed must also be stated.

Montana¹²

Scope: Commercial fertilizers are defined to include any substance sold for fertilizing, manurial, soil enriching or soil corrective purposes, the retail price of which is \$10.00 or more per ton. The law does not apply to animal manure which has not been artificially treated or to activated sludge which has been heat treated and which is sterile.

Registration Fees: The annual registration fee is \$25.00 per brand, expiring on January 1.

Tonnage Reports and Fees: Tonnage Fees are not required. However, statements must be submitted showing the amount of each brand sold for the periods of January 1-June 30 and July 1-December 31.

Labeling Requirements: In addition to a statement as to weight, brand, and maker, labels must show the minimum percentages and sources of nitrogen in available form, potash soluble in distilled water, available phosphoric acid, and also the minimum total phosphoric acid content. No other statement of chemical compounds may be made.

Nevada¹³

Scope: Under a new comprehensive fertilizer law, passed in Nevada during the 1931 legislative session, commercial fertilizers are defined to include substances and mixtures of substances containing 5% or more of nitrogen, available phosphoric acid, phosphoric pentoxide, or potassium oxide soluble in distilled water, single, collectively or in combination. Manures, hays, straws, peat, and leaf mold are excluded. Materials not containing at least 5% of plant food are classified as "agricultural minerals."

Registration Fees: The registration fee is \$25.00 per brand, expiring on June 30 of each year.

Tonnage Reports and Fees: In addition, an inspection fee is imposed at the rate of 20¢ per ton on every ton sold in packages, and 2¢ per ton for sales in bulk.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the chemical analysis. The analysis must show the minimum percentages and sources of total nitrogen, available phosphoric acid, total phosphoric acid, and soluble potash.

Unacidulated mineral phosphatic ma-

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EMULSIFIABLE CONCENTRATE

DUST BASE

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12 GAMMA

36 GAMMA

DIELDRIN

EMULSIFIABLE CONCENTRATE

DUST BASE

LINDANE

TECHNICAL

DDT

EMULSION
EMULSIFIABLE CONCENTRATE
WETTABLE POWDER
DUST BASE

EDCO CORP.

ELKTON MD

terials and basic slag must be guaranteed as to both total and available phosphoric acid and the degree of fineness. In the case of bone, tankage, and other natural organic phosphate materials, only the total phosphoric acid need be guaranteed.

Additional plant food elements may be guaranteed only by permission.

The Director may permit or require the potential basicity or acidity, expressed in terms of calcium carbonate equivalent in multiples of one hundred pounds per ton, to be guaranteed.

New Mexico⁴⁴

Scope: The law applies to any substance which, by reason of its chemical composition or other quality, is sold for the purpose of increasing the crops produced by land. The law does not apply to raw materials in the hands of manufacturers, nor to salt, limestone, dolomite, lime, slaked lime, gypsum, other materials of a like nature, or the dung of domestic animals when each is sold as such and unmixed.

Registration Fees: The annual registration fee is \$5.00 per brand, expiring on January 1.

Tonnage Reports and Fees: In addition, a tonnage tax is imposed at the rate of 25¢ per ton. Each package of commercial fertilizer sold must bear at least one tax tag or stamp certifying that the tax has been paid.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the percentages of nitrogen (phosphorous pentoxide, and dipotassium oxide, and the composition guaranteed by the manufacturer, as specified in the law.

In the case of fertilizers for which any claim of inoculation is made, the date of manufacture must also be stated.

Oregon⁴⁵

Scope: Commercial fertilizers are defined to include any substance designed for use principally as a source of plant food, in inducing increased crop yields or plant growth, or producing any physical or chemical change in the soil and containing 5% or more of available plant food. Hays, straws, peat, and leaf mold, and unmanipulated animal manures are excluded.

Registration Fees: An annual license fee of \$10.00 per brand is required, expiring on December 31.

Tonnage Reports and Fees: Under a 1951 amendment, an inspection fee is imposed at the rate of 10¢ per ton. The inspection fee for lime is 2¢ per ton. The fee is based on quarterly tonnage reports submitted in October, January, April, and July.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the chemical analysis. The analysis must show the minimum percentages of total nitrogen, available phosphoric acid, available potash, and the materials from which all of these constituents are derived.

Guarantees as to other plant foods may be made only with permission.

If the fertilizer consists entirely of

bone, or tankage, or natural organic phosphates, in which all of the phosphoric acid is not shown by laboratory methods to be available, the phosphoric acid content may be guaranteed on the label as total phosphoric acid, but in no case may both the total and available phosphoric acid be guaranteed on the same label.

Utah⁴⁶

Scope: Commercial fertilizers are defined to include any substance, except unmanipulated animal and fowl manure, designed and fit for use in inducing increased crop yields or plant growth when applied to the soil, whose aggregate content of nitrogen, available phosphoric acid, and available potash is 16% or more.

Fertilizer materials include any mineral substance, mixture of mineral substances, organic substance, or mixture of mineral and organic substances except unmanipulated animal or fowl manure, used as a source of plant food, either alone or in combination with soil conditioners, amendments, weed killers, or insecticides, which has an aggregate content less than 16% of nitrogen, available phosphoric acid, available potash, or contains other essential plant nutrients in any amounts.

Registration Fees: An annual registration fee of \$25.00 per brand and an annual license fee of \$25.00 are imposed.

Tonnage Reports and Fees: There are no inspection fees.

Labeling Requirements: In addition to

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THE MORE EFFECTIVE
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The powerful dispersing action of Marasperse is unaffected by the hardest waters. Marasperse enhances the action of wetting agents and permits the use of reduced amounts of these high cost components in formulations. A neutral compound, Marasperse will not affect toxicity of the insecticide.

Write for samples and additional information on Marasperse. Our technical staff will welcome the opportunity to cooperate with you.



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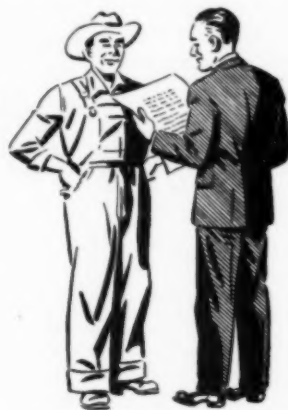
for Immediate Release:

"As a guide for farmers planning their next year's production, the U. S. Department of Agriculture today outlined the prospective 1952 supply situation for insecticides, fungicides and herbicides (weed killers). The situation indicates that farmers could help avert possible bottlenecks in supplies of these necessary materials by buying some part of their estimated requirements now and through continued orderly purchases in advance of actual needs . . ."

(From a U. S. D. A. News Release)

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Mixers who sell to dealers, and dealers who sell to farmers, will especially want to pass along this information. We hope to have plenty of agricultural pesticides, but in order to distribute stocks where they are needed, dealers and farmers should order at least half of their anticipated needs now. Drop us a line today. Take advantage of early season discounts and assure a supply.



Phenacide (Toxaphene)
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Tri-6 (BHC)

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AGRICULTURAL CHEMICALS

a statement as to weight, brand, and maker, labels must show the minimum percentages of total nitrogen, total phosphoric acid, available phosphoric acid, available potash, and other nutrient elements claimed.

If the foregoing does not adequately describe the fertility value claimed for the product, additional information may be permitted or required.

Washington⁶⁷

Scope: Commercial fertilizers are defined to include any substance, including any combination or mixture of substances whose aggregate content of nitrogen, available phosphoric acid, and available potash is 16% or more, and which is designed and fit for use as a source of plant food to increase crop fields or plant growth, except unmanipulated animal manures. (Fertilizer materials are defined similarly to the provisions of the Utah law noted above.) Soil builders are defined to include any mineral and organic substances, except sand and soil, used principally to add calcium, nitrogen, potassium, phosphorus, magnesium, or sulphur to the soil or as a means of producing physical or chemical changes in the soil for the purpose of improving plant growth.

Registration Fees: The annual registration fee is \$6.00 per brand.

Tonnage Reports and Fees: There are inspection fees.

Labeling Requirement: In the case of commercial fertilizers, labels must state, in addition to the statement as to weight, brand, and maker, the guaranteed chemical analysis showing in minimum percentages the total nitrogen, available phosphoric acid, available potash and other nutrient elements claimed.

Where bone is used, the total nitrogen, total phosphoric acid (percentage of available and from bone) total potash, and other nutrient elements must be shown.

There are detailed provisions setting forth the form of label in the case of soil builders.

Wyoming⁶⁸

Scope: Commercial fertilizers are defined to include any substance, including any combination or mixture of substances, designed and fit for use in inducing increased crop yields or plant growth when applied to the soil, except unmanipulated animal and vegetable manures, liming materials, and gypsum. Fertilizer materials include any substance which is, or may be used with another substance in the compounding of mixed fertilizers, or for direct application to the soil, principally as a source of plant food.

Registration Fees: The annual registration fee is \$25.00 per brand, expiring on December 31.

Tonnage Reports and Fees: In addition, each lot or parcel sold must have affixed thereto a tag or label secured from the Commissioner of Agriculture at a cost of 1¢ each.

Labeling Requirements: In addition to the statement as to weight, brand, and maker, labels must state the guaranteed analysis. The analysis must show the

minimum percentages of total nitrogen, available phosphoric acid, and available potash. In the case of mixed fertilizer, whole numbers must be used.

Footnotes

37. Wis. Laws 1961, c. 729
38. Ariz. Code Ann. 1939, sec. 49-601 et seq.
39. Cal. Agricultural Code sec. 1021 et seq. (Deering 1948), as amended by P.L. 1949, c. 1375, as amended by P.L. 1961, c. 139
40. Colo. Stat. Ann. 1955, 1950 Supp., c. 5 sec. 86 (1) et seq.
41. Idaho Code 1948, sec. 23-601 et seq., as amended by P.L. 1961, c. 106
42. Mont. Rev. Code 1947, sec. 2-1701 et seq., as amended by P.L. 1961, c. 129
43. Nev. Laws 1961, c. 203
44. N. M. Stat. 1941, sec. 48-1201 et seq., as amended by P. L. 1949, c. 106
45. Ore. Comp. L. Ann. 1949, 1948 Supp.,

- secs. 36-501 et seq., as amended by P.L. 1961
46. Utah Code Ann. 1943, 1949 Supp., sec. 3-8a-1 et seq.
47. Remington's Wash. Rev. Stat. 1932, as amended by P.L. 1961, c. 87, as amended by P.L. 1949, c. 143
48. Wyo. Comp. Stat. 1945, 1949 Supp., sec. 34-1101 et seq.

RECOMMENDATIONS

(Continued from page 53)

or toxaphene have been found satisfactory. A poison bait consisting of 40 percent of cryolite and 60 percent of citrus meal gives effective control.

Spider Mites. Several species of spider mites are known to attack cotton,

Better Protection... Better Yields

4 LBS. NET WEIGHT

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TRIANGLE BRAND
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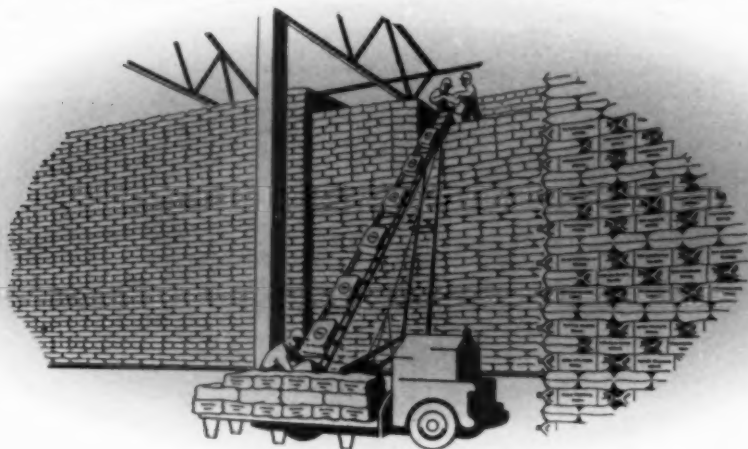
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Triangle Brand Copper Sulphate is dependable . . . safe and costs less. Yet, by actual field test, it gives greater yields! That's why growers actually use more Triangle Brand Copper products on their crops than any similar plant protection material. Don't be satisfied with "substitutes." Get the best—always demand Triangle Brand.

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Yes, a great deal more goes into Hammond Multi-Wall Bags than the hundreds of products that are now safely and dependably shipped in them. Here are a few reasons for Hammond's steady growth and for the steadily increasing demand for these Better Bags:

1. Only papers and materials of highest quality are used in the production of Hammond Multi-Walls.
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including the two-spotted spider mite, *Tetranychus bimaculatus* Harvey, and a recently described species, *Septanychus texazona* McG.

It is known that the use of certain of the organic insecticides for cotton insect control has resulted in serious spider mite infestations.

Sulfur, at the rate of 20 to 25 pounds per acre, has been the standard recommendation for the control of spider mites for many years, and satisfactory results have usually been obtained from its use. In some areas organic insecticide dusts for use on cotton have been formulated to contain at least 40 percent of properly conditioned dusting sulfur. The use of such formulations has usually prevented damage from spider mites.

During recent years other satisfactory miticides have been developed. Some of these synthetic substitutes were widely tested and used in 1951.

Since sulfur is now in critically short supply and since satisfactory substitutes are now available, it is recommended that sulfur be deleted from the local recommendations for control of cotton pests wherever and whenever it is felt that it is feasible to do so.

Parathion applied as a dust or spray at the rate of 0.10 to 0.25 pound per acre is highly effective against spider mites on cotton.

TEPP at the rate of 0.5 pint of the 40 per cent concentrate, or its equivalent, per acre, effectively controls heavy populations but its effectiveness is of short duration.

Aramite applied at a rate of 0.3 to 0.6 pound per acre gives good control of spider mites.

Several organic sulfur compounds are known to be more or less effective for spider mite control. These include sulfones, sulfites and sulfonic acid compounds. Erratic results have resulted from the use of these compounds and they are not generally recommended.

When the organic insecticides are applied as low-gallonage sprays, elemental sulfur cannot be incorporated in the spray formulations. When sprays are being used and the mite population begins to noticeably increase, aramite, parathion, or TEPP at the above dosages may be added to the next spray application for mite control.

Other compounds tested under field conditions during 1951 which appear sufficiently promising to justify recommending for extensive experimental use during 1952 are as follows:

- (1) EPN at a rate of 0.3 pound or more per acre.
- (2) Octamethyl pyrophosphoramide at 0.5 to 1 pound per acre.
- (3) Systox at 0.25 to 0.5 pound per acre.

Further experimental work on methyl ester of parathion, metacide, and compound 4049 at 0.25 pound or more per acre is justified.

TOXICOLOGY

(Continued from page 47)

due to ingestion, either accidental or intentional. Many poisons which are even less readily available have a far more impressive record of death and disaster than this material.

As might be expected, these chemicals whose use has been less widespread and whose availability is not so great have produced even less

striking records of illness and fatality. The fact that many of these compounds have been shown experimentally to have a toxicity which has been defined as being a certain number of times greater than that of DDT is not adequate reason to suspect that greater numbers of intoxications will occur during their use. The experience of several years of the manufacture, formulation and use of the various chlorinated hydrocarbons other than DDT has not produced collectively as many sus-

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pected cases of intoxication as has the DDT experience alone, despite the fact that these substances are all reported to be from twice to ten times as toxic as DDT itself. This may well be due to the general lack of availability of some of these substances, but it is entirely possible that the name, DDT, is much more familiar and therefore easier to indict when one feels the necessity for a causative agent. It is common knowledge today that most patients seem to feel that the cause of their symptoms can be found in external forces and that they usually attempt such correlations; the busy physician is not immune to the use of this same type of easy explanation.

The question of residues on foods has become most important from the point of view of the consumer and every effort should be and is being exerted to prevent undue contamination. It is true that toxic quantities of DDT are undesirable in milk, but it is equally true that DDT can be employed to control flies on cattle without resulting in deleterious levels in the milk. There is, therefore, a dosage at which the material will do no harm and this dosage is not unattainable. The gamma isomer of benzene hexachloride is readily absorbed through the intact skin but it is used as a scabicide and pediculicide on even abraded skin, in 1 per cent solution, with impunity.

If small amounts of the chlorinated hydrocarbon insecticides produce no adverse effects, will the storage of these materials in the body fat lead to the accumulation of levels which will eventually become toxic? This question is answered in the affirmative by some investigators and in the negative by others. It is not likely that easy agreement will ever come about regardless of the evidence. In terms of human experience, however, certain facts are known which indicate that storage is not synonymous with harmful physiological effects. These facts have been well established and have been verified on numerous occasions and may be enumerated as follows:

1. There is no evidence that adipose tissue has any metabolic function.
2. Although storage does occur to a greater or lesser degree, excretion takes place when the material is released and in human beings it has not been shown that mobilization of the material exceeds excretion.
3. No deleterious effects have been observed in exposed workers who have had continuous exposures followed by weight loss.
4. Human beings who have undergone chronic exposures have developed acute attacks only when sudden high concentrations have been absorbed.

Recovery from these attacks has been prompt and has not been followed by recurrences.

5. Sudden and great weight loss in humans is not common and when it happens, it is not in the same proportion as that which occurs in animals.

A serious consideration of these factors makes the hazard record of these materials even less menacing. It is notable that the medical profession itself with a very few vociferous exceptions has not become alarmed concerning the incidence of

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intoxications or fatalities by the chlorinated hydrocarbon insecticides. These few individuals whose opinions have had widespread publicity have been insisting that their conclusions are correct but they have rarely produced supporting evidence. In fact, one of the serious impediments to extensive clinical investigation has been the paucity of clinical cases and the rarity of autopsy material. This does not suggest that the toxicity of these materials has been underestimated.

Thus, when the record of actual human experience is examined carefully and when the consequences of many millions of man hours of exposure are critically evaluated, it seems unrealistic that great alarm should be expressed concerning the continued intelligent use of these toxic materials. It is a truism that no substance is so toxic that there is not a level below which it can be handled with impunity. Despite all precautions, however, accidents will continue to occur and dramatic incidents will become widely known. It is to be hoped fervently that the tremendous experience of safe usage will, in the future, be given the consideration it deserves when unfortunate and highly publicized incidents do occur. Common sense dictates that extrapolation and projection of empirical conclusions have no place in the scientific method.

Pseudo - scientific statements which are written to prove or disprove a thesis and which are couched in dramatic language are not designed to produce either scientific answers or any great service to the general public.

In the absence of factual information, it is remarkable to read and hear the many scare headlines and confidential statements which have been circulated concerning many of the agricultural chemicals. If these phrases were employed merely by recognized sensationalists and publicity seekers, they would perhaps attract little attention from those who have an earnest desire to ascertain the true value and dangers of the use of a specific material. Un-

fortunately, we now see this remarkably immature language being used by those who are considered to be mature scientists and in certain instances by responsible government officials. Compare the following quotations from the point of view of certain common advertising techniques which are designed to create excitement on radio and television:

"DDT and You! How It Menaces the Nation's Health."

"The Mysterious Ailment

Known as 'Virus X' . . . Is Actually DDT poisoning."

"Peril on Your Food Shelf."

"I would not touch DDT with a ten-foot pole."

"DDT is one thousand times more toxic than phenol."

These are but a few of the remarkable statements which have been produced by persons whose very position and background impose upon them the obligation of clear and accurate thinking and the

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definite duty of objective evaluation. It is, however, apparent that warnings of this type must be subject to serious suspicion of insincerity both because of the manner and places in which they have been publicized. The danger is not that these materials will cease to be manufactured, but that mass hysteria and confusion may be produced on the one hand and that indifference to actual danger will occur on the other when the predicted dire results fail to materialize.

AAEE MEETING

(Continued from page 38)

the past 5 years, there are very few recorded deaths attributable to insecticides, and all of them were apparently due to operational hazards and/or misuse of the material. I know of no accidental deaths actually attributable to pesticide residues in or on food."

The joint symposium concluded with three speakers discussing public relations and publicity to stimulate disease and insect control practices. Jerry Hurter, managing editor of the Cincinnati Times-Star told the group how an editor reacts to various types of news releases, emphasizing the importance of timeliness, local interest and terse writing in articles submitted. The competition for newspaper space is keen, he said, and editors must select only those stories of most interest to readers.

Francis Byrnes, Agricultural Editor, Ohio State University, presented a talk on "Making the Best of Bulletins, TV and Radio." He broke the releases into two groups: news and educational journalism. He said that one must visualize, analyze, organize and dramatize for effectiveness.

Charles Chupp, Cornell University, addressed the group on the subject of "public relations through the eyes of a plant pathologist." He said that extension people should know more about their subject than anyone else, including research people and teachers. Complete coopera-

tion with everyone who can help spread information was urged by Mr. Chupp. "Educate many persons and allow them to pass along the information," he said.

Another joint session of the AAEE section on insecticides and the APS section on fungicides was held Wednesday afternoon. Chairmen were Carl Weinman, Illinois Natural History Survey, Urbana; and Dr. George L. McNew, Boyce Thompson Institute, Yonkers, N. Y.

In a discussion on "The Principles and Progress in Developing Systemic Protection of Plants," Bruce D. Gleissner, Jr., American Cyanamid Co., New York stated that in a strict sense, systemic pesticides need not be toxic to insects in their original state, but may be converted by the plant into insecticides. Several studies, he said, particularly with octamethylpyrophosphoramide, indicate this to be true.

Studies have indicated that a



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systemic pesticide must be capable of absorption through the plant cuticle and transport in the sap stream and that the compounds must be freely soluble in water to accomplish this. However, the water solubility of "Systox" is one part in 15,000 parts of water . . . hardly a water-soluble compound.

It would appear therefore, he continued, that a compound can be highly liquid-soluble and, assuming water solubility as a requirement for translocation, then convertible into a water-soluble compound by enzymes or physiological processes within the plant. "In fact, it seems that the most recent studies on systemic compounds, especially those with OMPA, emphasize the importance of the plant in the synthesis of the actual compounds; also its distribution and final dispersion within the plant," he continued.

Regarding toxicity of systemics to warm-blooded animals, Dr. Gleissner cautioned against determining residues based on study of the original compound only, through the use of chemical methods of analysis or even insects for bioassay. The feeding of contaminated plant parts to warm-blooded animals and testing of treated plant extracts against the cholinesterase systems of warm-blooded animals will be required, he stated. Such studies are now under way, and their findings will help clarify this important phase of systemic pesticide use.

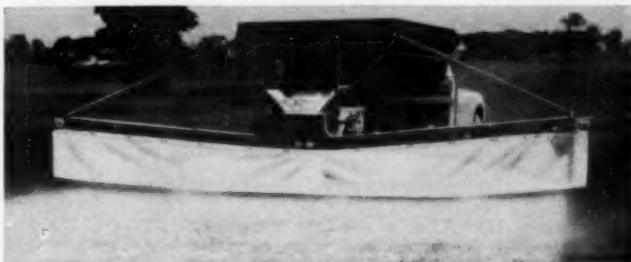
Dr. Richard H. Wellman, Carbide & Carbon Chemical Co., discussed the high cost of developing and marketing an agricultural chemical, following through the process from test tube to dealer's shelves. He reported that attorney's fees, field studies, toxicological studies, analytical methods, research and pilot plant construction and administration would run from a minimum of \$165,000 to perhaps \$355,000, the difference being largely in the cost of the pilot plant which could vary, he said, from \$75,000 to \$250,000. Added to this cost is the fact that only half of the materials tested are successful on the average, boosting the cost of the successful one to \$1,195,400. Be-

yond this is the cost of state and federal work on the material, which will cost around \$150,000, he said, and finally, the cost to the company of samples and a liaison man, amounting to some \$33,000. The grand total, therefore, would be \$1,347,400.

"There can be no question but what this expenditure has been and will continue to be justified as far as the farmer is concerned. . . . I believe also that this research can be profitable to companies, provided they can afford to invest a million or more

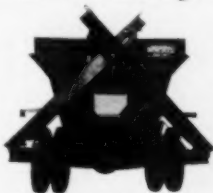
over a five to ten year period before expecting a return on their investment, and then to invest from 2 to 10 million more in plant to take advantage of their research.

In the same symposium, Dr. George C. Decker, Illinois Natural History Survey, presented a paper, "Legislative Control of Pesticide Usage." He declared that man has always required some kind of legislation to maintain civilization, but the question is, how much regulation is reasonable, safe, sound and neces-



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Pump No.	Pipe Size	Jan.	Feb.	March	April	May	June
2AX or 2ZX	1/4"	500	500	500	500	250	250
3AX or 3ZX	3/8"	500	500	500	500	250	250
4AX or 4ZX	1/2"	2000	2000	2000	2000	1000	1000
7AX or 7ZX	3/4"	2000	2000	2000	2000	1000	1000
9AX or 9ZX	1"	2000	2000	2000	2000	1000	1000
2000	3/8"	250	250	250	250	125	125
3000	1/2"	250	250	250	250	125	125
4000	1/2"	500	500	500	500	250	250
7000	3/4"	1000	1000	1000	1000	500	500
9000	1"	1500	1500	1500	1500	750	750

Pump No.	Price	Pump No.	Price	Pump No.	Price
2AX —	\$13.25	4ZX —	\$22.00	2000 —	\$15.75
2ZX —	17.50	7AX —	22.50	3000 —	20.00
3AX —	15.50	7ZX —	27.75	4000 —	22.25
3ZX —	20.50	9AX —	23.75	7000 —	28.50
4AX —	17.00	9ZX —	29.00	9000 —	29.75

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sary. The Federal Insecticide, Fungicide Act of 1947, he said, regulates the movement and use of economic poisons through its registration and labeling requirements. Enforcement is simplified by the provision for prohibiting the shipment of a product in interstate commerce until it has been registered with the U.S.D.A. "Obviously," he pointed out, "The supporting evidence submitted with the application must establish beyond any reasonable doubt that when the product is used in accordance with directions of commonly-recognized practice, it will not be injurious to man, other vertebrate animals, vegetation, the person applying such poisons, nor endanger the public health." Dr. Decker reminded that the Secretary of Agriculture may refuse registration if doubt exists, but that the registrant has the right to proceed under protest if he feels that the Secretary's decision is unjust or arbitrary.

The Federal Food, Drug and Cosmetic Act of 1938 was reviewed by Dr. Decker, who declared that "it would appear that the F.D.A. has ample authority to protect the public from dangerous pesticide residues on foods. If the Administrator finds that a poisonous or deleterious substance is required in the production of a food or that it cannot be avoided by good manufacturing practices, he is obligated to promulgate regulations limiting the quantity therein or thereon . . . in other words, to establish a tolerance. On the other hand, if he finds such a substance is not necessary in production, or could be eliminated, proceedings can be instituted under Section 402 of the Act."

The Illinois entomologist continued by reminding that in addition to the two federal statutes, at least 39 states have legislation regulating the movement and use of pesticides, and many states have provisions governing pesticide residues on or in foodstuffs.

"Many people believe that existing legislation is adequate, particularly if it were fully utilized by the

agencies having the responsibility for its administration," he concluded. "This being true, it would be optimistic indeed to hope that new legislation could improve on the potentialities of existing laws. Developments of the past several months have given rise to speculation that some agencies may wish to divert attention from their failure to administer existing laws by creating a smokescreen of alleged need for new legislation."

Dr. Frank Princi, Kettering Laboratory of the University of Cincinnati, presented a scholarly paper on "The Toxicology and Hazard Record of New Pesticides," pointing out the actual history of some of the newer toxicants, indicating that in view of the tremendous quantities of materials used, the rate of injury is small. (Dr. Princi's complete paper appears elsewhere in this issue.)

In a session Wednesday evening, C. H. Krieger, Wisconsin

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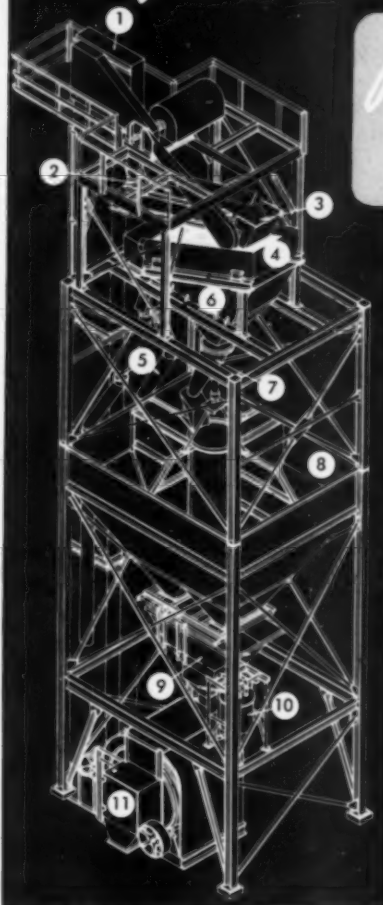
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3. Self-cleaning belt conveyor feeds the pulverized material from clod breaker to screen.
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Alumni Research Foundation, Madison, Wis. presented a paper on rodenticides, tracing their history from arsenic to warfarin. He reviewed the latest methods of rat and mouse control by warfarin, pointing out that its use fails to create bait-shyness in rats and gives unusually effectiveness in reducing the rodent population. A question-and-answer session following the paper brought out further information regarding secondary poisoning of pets upon eating warfarin-poisoned rats. This possibility was declared to be a potential hazard, although thus far it has not been a serious one.

The final day of the AAEE meeting was devoted to two sessions; the first, a joint session with the Potato Association of America, under the chairmanship of Drs. Bailey B. Pepper, Rutgers University, New Brunswick, N. J. representing the A.A.E.E.; and Ora Smith, Cornell University, Ithaca, N. Y., the Potato Association.

The other concurrent session covered the subject of insect pest surveys. Avery S. Hoyt, chief, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture was chairman of this portion of the program which included papers by J. J. Davis, Purdue University; Dr. Decker; M. R. Clarkson, special assistant to the Administrator of the A.R.A., in charge of Defense Efforts; H. M. Armitage, chief, California State Bureau of Entomology, Sacramento; W. C. Nettles, Clemson Agricultural College, Clemson, S. C.; and Kelvin Dorward, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The A.A.E.E. banquet was held Tuesday evening, followed by an evening of entertainment by Dr. Isay Balinkin, University of Cincinnati, who presented a lecture-demonstration on color phenomena.

Both the A.A.E.E. and the A.P.S. scheduled entertainment for the ladies present. Tours of the Cincinnati area were arranged, including the Art Museum and a guided tour of the Procter and Gamble factory.

AGRICULTURAL CHEMICALS

APS MEETING

(Continued from page 38)

use of a fungicide. Safety is an expression of the probability that normal use or probable misuse of a product will result in human contact, absorption or ingestion of too great an amount to be tolerated. For estimation of safety, the degree and frequency of human contact with the fungicide must be considered together with the toxicology of the material. How much of the fungicide will a workman absorb during synthesis of the compound and how many days a year will he be exposed? How much and how often will a formulator and repackager be exposed? How much and how often will an agricultural worker be exposed? How much residue will be present in the food consumed by the public? Numerical estimates of these amounts must be available before toxicological information can be evaluated in terms of safety. Toxicological experiment is most economical if the estimates are available before animal study is started," he continued.

Dr. Smyth declared that in order to enforce any established tolerances for fungicidal residues on foods, an analytical method of determination of such residues must be available. Otherwise, he said, establishment of a tolerance is "meaningless and useless."

Toxicological study should start well before the end of a five-year study of effectiveness in the field, Dr. Smyth declared, adding that at least 30 months of toxicological study will be required to determine whether or not the use of the given material is safe. By treating the toxicological study as a necessary part of the development program rather than as a separate and distinct function, much time will be saved in the development of a fungicide. While some toxicological work may be lost if a material fails to survive field tests, "such waste is better than the loss of two years of time . . .," he said.

W. K. Smith, Rhode Island Agricultural Experiment Station, Kingston, described the physical and chemical properties of a number of antifungal antibiotics which have been studied at the Butterwick Research laboratories of Imperial Chemical Industries, Ltd., in Great Britain. The materials are all very potent, Dr. Smith declared.

Dean Asquith, Pennsylvania State College, told of experiments on the concentrate spraying of apple

trees in Pennsylvania. By changing to concentrate sprays in Pennsylvania, the paper said, results were better than anticipated. When using a dilute spray, a maximum of 25 acres a day was about all that could be expected. But the same machine, having been equipped for concentrate spraying will cover 50 acres in a day. "This means that a grower of 150 acres of orchard can concentrate spray his trees every week . . . but it often takes well into the sec-

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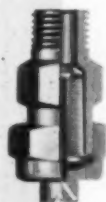
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ond week to complete the job with a dilute spray." He concluded that since the control of fruit pests is the most expensive operation in the production of commercial fruit crops, the development of concentrate spraying will help to alleviate this phase of the growers' problem.

The program of the Science Service Laboratory of London, Ontario, was described by Dr. Hubert Martin, director. He said that the number of different chemicals, as distinct from formulated products, is about 200 percent. These, are the chemicals in active use in pest and disease control and those which appear sufficiently promising for commercial development though now in the experimental stage.

The Phytopath banquet was held Tuesday evening, followed by a brief program at which Dr. James G. Horsfall was master of ceremonies. The banqueteers were shown "How to Present a Scientific Paper" in a humorous skit by Thor Kommedahl, and were further entertained by a chalk talk by Eric Sharville. It was at this meeting that Dr. Horsfall presented the newly-elected officers.

MALEIC HYDRAZIDE

(Continued from page 43)

the acid, which is used as a promising stop-drop spray, has been reported to cause an increased rate of respiration and consequent early breakdown of the apples in storage.

Not to be overlooked, is the importance of testing other materials which cause in plants similar basic physiological responses to those caused by maleic hydrazide. Meanwhile, it appears likely that maleic hydrazide will assume an important place among the agricultural chemicals.★★

Literature Cited

- ¹ Foersterling, H. A. Hydrazinhydrat and anhydride zweibasischer säuren. J. Prakt. Chem. (2) 51: 371-398. 1895.
- ² Schoene, D. L. and Hoffman, O. L. Maleic hydrazide, a unique growth regulant. Sci. 109 (284): 588-590. 1949.
- ³ Manufactured by Naugatuck Chemical, a Division of The United States Rubber Company, Naugatuck, Connecticut.

JANUARY, 1952

WEED CONFERENCE

(Continued from page 55)

tive when in contact with the soil and not unlike 2,4-D in its action.

A paper by Prof. G. L. Shanks, an authority on chemical application machinery, stressed the steady improvements in machines, especially means of filling tanks rapidly and in nozzle refinements. Shanks felt the wide-angle nozzle

may have far-reaching effects upon spraying techniques.

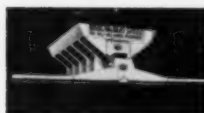
The Conference banquet was attended by the Hon. H. R. Bowman, Minister of Agriculture for B. C., who in welcoming the delegates, noted the rapidly changing picture of weed control in the last few years and how new weed chemicals had added new hope to the problem. Guest speaker at the banquet was F. L. Timmons, U.S.D.A. co-ordinator weed researcher, for 11

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Western States with headquarters at Logan, Utah. His subject was "Weeds and Weedmen South of the Border;" by means of colored slides he took his audience on a tour of the irrigation and range lands, not to mention mountains, of the large area he serves. Chemicals used under a wide variety of conditions and weed species have long been a strong aid in helping to counteract the inroads of weeds and woody growth.

Next year's conference goes to Manitoba under the direction of Messrs. H. E. Wood, P. J. Olson, H. A. Craig and H. J. Mather. The Western Canadian Conference extended an invitation to the North Central Weed Control Conference to join with them by holding its 1952 Conference in Winnipeg.

FUNGICIDES

(Continued from page 71)

Both ferbam and nabam gave economic control of *Botrytis* leaf-

spot of gladiolus under Oregon conditions. Although ferbam was most effective in disease control, it has the undesirable quality of leaving a conspicuous black residue on foliage and flowers. For this reason ferbam has been recommended to those growers who grow for corn production only or where sale of cut flowers is not involved. Nabam has been recommended for use when cut flowers are to be sold.

New Controls Needed

ACCORDING to W. F. Mai, Bert Lear, and C. W. Boothroyd, of Cornell University, the bacterium *Corynebacterium sepedonicum*, the casual organism of ring rot of potatoes, and the fungus *Fusarium sambucinum*, a cause of potato seed piece decay, can be spread from farm to farm on burlap bags. Treatment of bags by immersion in hot water or dipping in chemical solutions results in rotting unless the bags are rapidly

and thoroughly dried after treating. A treatment lethal to both of the above organisms, and especially to the ring rot bacteria, but non-injurious to bags is urgently needed because of the scarcity and high price of burlap.

Methyl bromide has been reported toxic to the bacterium causing ring rot at the rate of 19 pounds per 1000 cubic feet for 16 to 20 hours. A volatile chemical such as methyl bromide would be particularly suitable for treating burlap bags because it penetrates rapidly and disappears quickly from closed chambers after the exposure period. Because of the possibility of its use as a practical method for treating burlap bags, extensive tests were made of the toxicity of methyl bromide to the two organisms.

The toxicity to the ring rot bacterium was tested as follows. Round toothpicks were contaminated by contact with infected tuber tissue. After drying for 24 hours, the con-

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taminated toothpicks were exposed to the desired methyl bromide treatment in a fumigation chamber constructed from a large pressure cooker. In one test, involving the highest dosage and longest exposure period, the union between the lid and pan of the pressure cooker was sealed with heavy cellophane tape to make certain that gas was not escaping. After aeration for 24 hours, the contaminated end of each toothpick was forced into the stem of a small Bonny Best tomato plant. The tomato plants were observed over a period of three months for the appearance of ring rot symptoms.

Increasing the dosage or lengthening the exposure period resulted in slower development of the ring rot symptoms in the tomato plants. Symptoms developed at a more rapid rate when the tomato plants were small at the time of inoculation.

For testing the toxicity of methyl bromide to *Fusarium sambucinum*, toothpicks were contaminated by contact with sporulating cultures of this organism growing on potato dextrose agar. The contaminated toothpicks were allowed to dry, exposed to methyl bromide in the fumigation chamber, serated, and then placed on potato dextrose agar. When the fungus was not killed by the treatment, colonies appeared on the agar in from two to four days.

The results of all treatments are recorded in Tables 3 and 4. Dosages of methyl bromide up to 60 pounds per 1000 cubic feet for 16 to 20 hours exposure at temperatures ranging from 72° to 80°F. were ineffective in killing either of these organisms. Longer exposure periods or higher dosages were not considered practical.

WASHINGTON

(Continued from page 75)

duce at least 6,000,000 bales to meet heavy demands under the preparedness program as well as to supply customers abroad and domestic customers. The acreage actually harvested was estimated at 26,698,000 acres

compared with 17,843,000 last year and 21,622,000 for the ten year average.

* * *

A recent export advisory committee of agricultural insecticide producers, Office of International Trade, requested that organization to increase licensed exports of DDT so manufacturers can keep "production on a stable economical basis." The meeting, held in the early part of December, consisted of representatives from various companies producing commodities within the agricultural pesticide field, including producers of DDT, BHC, copper sulfate as well as formulators and consumers of these materials. Representatives of export firms were also present.

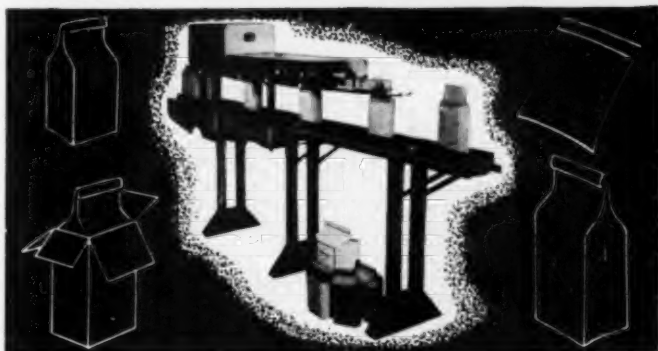
Producers of DDT requested that exports should be increased from the October through March period so that production does not have to be cut when domestic consumers are

normally not taking in materials.

It was pointed out that DDT production is running higher than early estimates of 105,000,000 lbs. for the period October 1, 1951 through September 30, 1952. Accordingly, the industry spokesmen pointed out that exports could be stepped up without jeopardizing delivery of 85,000,000 lbs. of DDT required for domestic use during the current year.

However, these industry spokesmen apparently failed to realize that the National Production Authority is providing for only 105,000,000 lbs. of DDT, approximately 85,000,000 of which is destined for domestic use and the balance for export. Therefore, if production runs ahead of the 105,000,000 pound figure, then it may well be that benzene, chlorine and sulfuric acid, the three critical components used to make DDT, can be cut off when this production goal is obtained.

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(The Advertisers' Index has been checked carefully but
no responsibility can be assumed for any omission)

TALE ENDS

WE are flattered at the great number of holiday greetings received from our friends everywhere. If it were possible, we'd send a personal "thanks" for every such remembrance, but this general acknowledgment carries with it the essence of what we wanted to say.

If all the good wishes we received were to be realized, we'd

certainly have a wonderful 1952! (and we expect to have it, thanks)

As a matter of fact, you'll note on this month's cover, that we are beginning volume 7 of *Agricultural Chemicals*. Many of our subscribers tell us that they have a complete set of copies, dating back to Vol. I, No. 1, in 1946. From others who lack some of the older numbers,

we are frequently besieged by requests for certain of these. Regrettably, we have to say, "there are no more."

So those of you who have those early copies, better hang on to them!

The thief in New York's Bronx who swiped a suitcase from an apartment house the other day, may have received his retribution by now. In the case were jars labeled "baby powder," "talcum," etc. But instead of containing these innocent commodities, the cans held materials such as DDT, arsenic, chlordane and maybe parathion . . . the working tools of an exterminator who owned the bag.

New York police, apprised of the act, sent out hasty warnings to the unknown bag-snitcher hoping not so much to catch the culprit, but to spare members of his family from injury. To date, no follow-up on the story has been heard.

The recent AAEE-APS meeting kept many conventioners on the jump. With each group holding concurrent sessions, this meant that as many as ten sessions would be under way at the same time. Persons interested in more than one subject, often found themselves scurrying from room to room trying to catch at least a little of the goings-on. Many who registered for both meetings must have had a confusing time in switching badges as they changed from entomologists to plant pathologists and vice versa. Anyway, the meeting was regarded as "very successful" by spokesmen of both groups.

The National Agricultural Chemicals Association, in announcing the dates of April 6-9 for its spring meeting at the Fairmont Hotel, San Francisco, urges everyone to get reservations made early. A good-sized crowd is expected to be in attendance, not only from the western states, but from other parts of the country as well.

Greetings!



OUR old pal, Cuthbert, has received his draft "greetings" from Uncle Sam! His services are needed. Just like any firm with a specific industrial advertising job to do needs the services of good business publications. For example, if the job be to blanket the field of chemicals for agriculture, naturally they would call on

AGRICULTURAL CHEMICALS

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NO. 2 OF A SERIES

Stretch a MULTIWALL Paper Bag



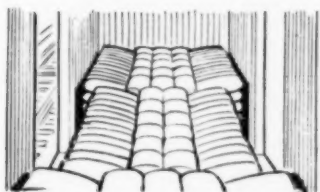
Kraft paper supplies are short. So it is important for you to get the best use from your multiwalls. Here is one way to stretch them . . .

PROPER CAR LOADING

PREPARATION IS IMPORTANT

Cars should be clean, dry, and free from protruding nails or other projections. Remove all dirt, dust, rocks and grit from floor and walls. Remove loose nails and cover loose bolts with cardboard or several thicknesses of car liner. (Picture shows how to use straight-edge board to locate protruding nails, etc.)

Cover floor with good grade of car liner and put at least three thicknesses on door edges. Line walls, too, if they are in bad condition. Use asphalt-laminated paper to seal door cracks against dirt, rain, snow and cinders.



FOLLOW THESE LOADING RULES:

- 1** The car should be loaded so that the filled bags will not come in contact with side doors.

- a. Use a good grade of dunnage in the doorway or steel strapping covered with corrugated board.
- b. Follow proper loading patterns. (See illustrations.)
- c. Use retaining strips of special Scotch tape applied across the load, or steel retaining straps covered by one thickness of corrugated board.

- 2** Bags should be loaded tightly, solidly and flat, to minimize shifting in transit.

- 3** Balance the load so there will not be more weight on one end or side than on the other end or side.

There are, in general, three different methods of loading—crosswise, brickwall and lengthwise. The crosswise method is generally considered to be the most acceptable.

Loading in car doorways should be done in such a manner that this part of the load acts as a keystone between the loads in the ends of the car. (See illustration.)

Want the Whole Story?

Ask your Bemis Man for free, illustrated copy of Bemis Multiwall Packaging Guide. It deals with Storage, Filling and Closing, Handling, Palletizing and other important subjects.

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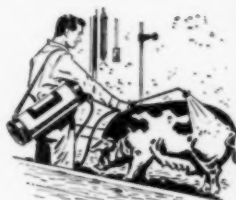
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Versatile Pyrenone gives insecticides a combination of effectiveness against a wide range of insects, economy, and freedom from toxic hazards that is unmatched. That's why it is helping progressive formulators in every field to tap new markets—to build new profits. That's why more than 90 per cent of all aerosols and oil-type dairy sprays are based on Pyrenone, and there is increasing use of Pyrenone in food plant and warehouse sprays, industrial insecticides and other pest control products.

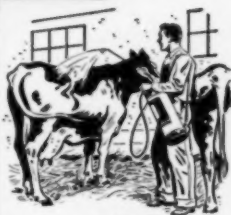
Pyrenone can be used in water emulsions . . . oil-type sprays . . . wettable powders . . . and dusts. We will gladly furnish formulating and labeling information to help you to serve American industry and agriculture with effective insecticides.

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Put Pyrenone* on your label**

Write today for "Quick Facts about Pyrenone" a handy reference guide filled with condensed product and end-use data, or for use of the Pyrenone* trade mark.



LIVESTOCK



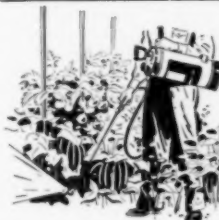
DAIRY



FOOD STORAGE



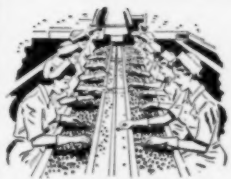
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